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12th Annual Science & Engineering Technology Conference/DoD TECH Exposition

"Linking the DoD S&T Program to Key Mission Areas"

NORTH CHARLESTON, SC

21 - 23 June 2011

Agenda

TUESDAY, JUNE 21, 2011

Keynote Address

- The Honorable Zachary J. Lemnios, Assistant Secretary of Defense for Research & Engineering

FY 2012 President's Budget Request for DoD S&T Program

- Mr. Robert W. Baker, Deputy Director, Plans & Programs, OASD(R&E)

DoD Basic Research Program with a Focus on Academia

- Dr. Randy Avent, Chief Scientist, Basic Science Office, OASD(R&E)

Rapid Fielding Directorate's Portfolio of Opportunities

- Mr. Earl Wyatt, Deputy Assistant Secretary of Defense, Rapid Fielding, OASD(R&E)

The DoD T&E/S&T Program

- Mr. George Rumford, T&E/S&T Program Manager, Defense Test Resource Management Center

Process Used to Develop the DoD Science & Technology Priorities

- Mr. Robert W. Baker, Deputy Director, Plans & Programs, OASD(R&E)

Data to Decisions

- Dr. Randy Avent, Chief Scientist, Basic Science Office, OASD(R&E)

Autonomy

- Dr. Bobby Junker, Head, C4ISR Department, Office of Naval Research

Human Systems

- Dr. John F. Tangney, Director, Human & Bioengineered Systems Division, Office of Naval Research

Engineered Resilient Systems

- Dr. Randy Avent, Chief Scientist, Basic Science Office, OASD(R&E)

WEDNESDAY, JUNE 22, 2011

Providing Technology Enabled Capabilities

- Mr. Jeff Singleton, Director for Basic Research, Office of the Deputy Assistant Secretary of the Army (Research & Technology)

Overview of Naval Science, Technology, and Engineering

- Dr. Joseph Lawrence, III, Director of Transition, Office of Naval Research

Discussion on Navy and Marine Corps Technology Needs

Moderator: Dr. Joseph Lawrence, III, Director of Transition, Office of Naval Research

- Mr. Michael Bosworth, Acting Chief Technology Officer, Naval Sea Systems Command
- Ms. Rebecca Ahne, Deputy Chief Technology Officer, Naval Aviation Enterprise
- Mr. James H. Smerchansky, Deputy Commander Systems Engineering, Interoperability, Architectures, & Technology, Marine Corps Systems Command

Overview of Air Force Science, Technology, and Engineering

- Colonel Mark Koch, USAF, Associate Deputy Assistant Secretary of the Air Force (Science, Technology & Engineering)

High Velocity Penetrating Weapon (HVPW)

- Mr. Leo Rose, U.S. Air Force Research Laboratory/RW, Program Manager

Responsive Reusable Booster for Space Access

- Mr. Bruce Thieman, Air Vehicles Directorate, U.S. Air Force Research Laboratory

Precision Airdrop

- Dr. Keith Bowman, Air Vehicles Directorate, U.S. Air Force Research Laboratory

THURSDAY, JUNE 23, 2011

How Capabilities are Developed and Delivered to the Combatant Commanders

- Mr. Robert W. Baker, Deputy Director, Plans & Programs, OASD(R&E)

USCENTCOM

- Mr. Eric A. Follstad, Chief, Transformation & Concept Development, USCENTCOM

USSOCOM

- Ms. Lisa Sanders, Deputy Director Science & Technology, USSOCOM

USPACOM

- Mr. Ken Bruner, Science Advisor, USPACOM

USSOUTHCOM

- Mr. Ricky Stuart, Technology Manager, USSOUTHCOM

USTRANSCOM

- Mr. Lou Bernstein, Chief, Future Capabilities & Technology, USTRANSCOM

USSTRATCOM

- Mr. Dave Tyner, Science & Technology Advisor, USSTRATCOM

USNORTHCOM

- Dr. Susanne Wirwille, Director, Science & Technology, NORAD and USNORTHCOM

USEUCOM

- Mr. Stephen L. Spehn, Deputy Science Advisor, USEUCOM

12TH ANNUAL **SCIENCE & ENGINEERING TECHNOLOGY CONFERENCE / DoD TECH EXPOSITION**

Linking the DoD S&T Program to the DoD S&T Priorities

**CONFERENCE
AGENDA**

**EXHIBITOR
PROFILES**

**ATTENDEE
ROSTER**



LOCATION

Charleston Convention Center
5055 International Boulevard
North Charleston, SC 29418

ATTIRE

Appropriate dress for the conference is business coat & tie for civilians and Class A uniform or uniform of the day for military personnel.

ID BADGES

During conference registration, each Attendee will be issued an identification badge. Please be prepared to present a valid picture ID. Badges must be worn at all conference functions.

CLASSIFIED SESSION

Registered NDIA S&ET Conference Attendees are invited by OASD(R&E) and SPAWAR to attend a Classified Session held off-site. Classified Session Attendees must hold a Secret Level Clearance Classification and must have submitted and verified their clearance acceptance with the SPAWAR security office by Friday, June 10, 2011.

PROCEEDINGS

Proceedings will be available on the web through the Defense Technical Information Center (DTIC) two weeks after the conference. All registered Attendees will receive an email notification once the proceedings are available.

ADVERTISING

Advertise in *National Defense* magazine and increase your organization's exposure. *National Defense* will be distributed to Attendees of this event, as well as other NDIA events. For more information, contact Dino Pignotti, NDIA, at (703) 247-2541 or dpignotti@ndia.org.

CONTACTS

Ms. Mary Anna Christiansen
Meeting Planner, NDIA
(703) 247-2596 or mchristiansen@ndia.org

Ms. Alden Davidson, CEM
Associate Director of Exhibits, NDIA
(703) 247-2582 or adavidson@ndia.org

INTRODUCTION

12TH Annual S&ET Conference / DoD Tech Exposition June 21 - 23, 2011 Charleston Convention Center North Charleston, SC

Linking the DoD S&ET Program to the DoD S&ET Priorities

The 12th Annual S&ET Conference / DoD Tech Exposition will occur on June 21 - 23, 2011, at the Charleston Convention Center, North Charleston, SC. This year's conference is dedicated to the memory of Dr. A. Louis Medin, the founding Chairman of the NDIA S&ET Division.

The 2010 Quadrennial Defense Review (QDR) identified the need for the DoD to "rebalance its policy, doctrine, and capabilities to better support 6 key missions." Success in the QDR's key mission areas is dependent on the development, integration, and timely deployment of critical core capabilities. These capabilities must align to the dynamic threat environment, evolving mission architectures, and are enabled by critical investments in science and technology.

The ASD(R&E), with the support of the Services, Agencies and Joint Staff, led studies to identify the core capabilities and enabling technologies for each of the six QDR key mission areas. These studies were completed and identified near and long-term technology investments that will be required to contribute to success in these mission areas. The DoD Science & Technology (S&T) Executive Committee considered the results of these studies, along with Service S&T priorities, and the recommendations of DoD S&T Communities of Interest and DoD Technology Focus Teams, to develop a list of 7 DoD S&T Priorities. These 7 DoD S&T Priorities were documented in a memorandum signed by the Secretary of Defense on April 19, 2011. In this memorandum, the Secretary directed that implementation roadmaps be developed for each S&T Priority to coordinate the Department's "investments in the priority areas to accelerate the development and delivery of capabilities consistent with these priorities."

Speakers from the DoD will present background information, a status update, and the technology challenges associated with each of the 7 S&T Priorities, plus technology investments the Services are making to achieve success in each of the 7 S&T Priority areas. Briefers will highlight opportunities for industry collaboration with Services and Agencies and identify technology areas in which industry may want to consider making independent (IR&D) investments. Speakers will be available in the "Speakers Corner" after each session. The conference will again, this year feature poster paper sessions with authors available for discussion and interaction on emerging concepts and technology. There will also be opportunities for industry and academia to present ideas to Service representatives in One-On-One Sessions. Sign-up sheets will be available at the Conference Registration Desk. The DoD Speakers will also be available to discuss new business opportunities.

S&ET Division Chair:

Mr. James Chew, Director, Advanced Technologies & Concepts, L-3 Communications

S&ET Division Vice Chair:

Dr. Jocelyn Seng, Research Staff, Institute for Defense Analyses, (Brigadier General, USAFR)

S&ET Division Secretary:

Mr. Michael Liggett, Director Technology Programs, Raytheon Company

S&ET Conference Co-Chairs:

- ▶ Mr. Robert W. Baker, Deputy Director, Plans & Programs, OASD(R&E)
- ▶ Dr. Preston W. "Chip" Grounds, Director Electronics, Sensors, & Networks Research Division, Office of Naval Research
- ▶ Mr. Chris Miller, Executive Director SES, SPAWAR

CONFERENCE AGENDA

TUESDAY, JUNE 21, 2011

7:00 AM – 6:30 PM

Conference Registration

Ballroom A & B Foyer

7:00 AM – 8:00 AM

Continental Breakfast

Ballroom A & B Foyer

8:00 AM – 8:15 AM

Welcome Remarks

General Session - Ballroom A & B

► Major General Barry D. Bates, USA (Ret),
Vice President of Operations, National Defense
Industrial Association

► Mr. James Chew, Director, Advanced
Technologies & Concepts, L-3 Communications;
S&ET Division Chair

8:15 AM – 9:15 AM

Keynote Address

General Session - Ballroom A & B

The Honorable Zachary J. Lemnios, Assistant
Secretary of Defense for Research & Engineering

9:15 AM – 12:15 PM

FY 2012 President's Budget Request and Opportunities for Collaboration Session

General Session - Ballroom A & B

In this session, we will present the Fiscal Year 2012 President's Budget Request for the DoD S&T program. Specific programs that provide conference Attendees opportunities to engage in collaborative efforts with the DoD S&T community will also be highlighted. Presentations will provide information on technology areas of high interest to the DoD, time lines, and points of contact for the submission of proposals. Opportunities for both industry and academia will be covered. A wide range of programs, from the larger technology demonstrations funded by the Joint Capability Technology Demonstration program, that lead to the evaluation of military utility of advanced technology by a Combatant Commander; to the more focused technology development efforts that are funded by the Test & Evaluation/Science & Technology (T&E/S&T) program will be covered. Opportunities for proposing commercial off-the-shelf technology to meet current military needs will be addressed by "The Rapid Fielding Directorate's Portfolio of Opportunities" presentation. The session will be rounded out with brief presentations by poster paper Authors, highlighting the topics of poster papers that will be on display.

Co-Chairs:

► Dr. Raj K. Aggarwal, Managing Director,
Advanced Research & Technology, College of
Engineering, Iowa State University

► Mr. Michael Liggett, Director Technology
Programs, Raytheon Corporation

ONE-ON-ONE SESSIONS

There will be the opportunity to meet with a USA, USN or USAF Representative in One-On-One Sessions. You may sign-up for your private, 15 minute One-On-One Session on-site at the Conference Registration Desk. Reservations will be on a first-come, first-served basis, and will be limited to one session with each Service.

ONE-ON-ONE REPRESENTATIVES

Army:

► Mr. Thomas Haduch, Chief, Cross
Command Integration, Programs &
Engineering U.S. Army Research,
Development and Engineering
Command

► Ms. Lucy Priddy, Engineer Research
& Development Center, CoE

► Mr. Jeff Singleton, Director for Basic
Research, Office of the Deputy Assistant
Secretary of the U.S. Army Research &
Technology

Navy:

► Mr. Craig Hughes, Deputy Director
of Innovation, Office of Naval Research

► Dr. Joseph Lawrence, Director of
Transition, Office of Naval Research

► Dr. Kam Ng, Deputy Director of
Research, Office of Naval Research

► Mr. Bob Smith, Director, Technology
Transition Initiatives, Office of Naval
Research

► Mr. Eric Wilson, Deputy Director of
Transition, Office of Naval Research

Air Force:

► Mr. Chris Clay, Deputy Division
Chief, Science and Technology Division,
Office of the Deputy Assistant Secretary
of the U.S. Air Force for Science,
Technology, and Engineering

SPEAKER DONATION

In lieu of Speaker Gifts, a donation has been made to the Wounded Warrior Project. For additional information, please visit:

www.woundedwarriorproject.org

SURVEY

A survey will be e-mailed to you after the event. NDIA would appreciate your time in completing the survey to help make our event even more successful in the future.

TUESDAY, JUNE 21, 2011

- 9:15 AM – 9:45 AM **FY 2012 President's Budget Request for DoD S&T Program**
Mr. Robert W. Baker, Deputy Director, Plans & Programs, OASD(R&E)
- 9:45 AM – 10:15 AM **Networking Break**
Exhibit Hall - Exhibition Hall A
- 10:15 AM – 10:45 AM **DoD Basic Research Program with a Focus on Academia**
Dr. Randy Avent, Chief Scientist, Basic Science Office, OASD(R&E)
- 10:45 AM – 11:15 AM **Rapid Fielding Directorate's Portfolio of Opportunities**
Mr. Earl Wyatt, Deputy Assistant Secretary of Defense, Rapid Fielding, OASD(R&E)
- 11:15 AM – 11:45 AM **The DoD T&E/S&T Program**
Mr. George Rumford, T&E/S&T Program Manager, Defense Test Resource Management Center
- 11:45 AM – 12:15 PM **Poster Paper Author Presentations**
General Session - Ballroom A & B
- 12:15 PM – 1:15 PM **Networking Buffet Lunch**
Exhibit Hall - Exhibition Hall A
- 1:15 PM – 2:15 PM **DARPA Session**
General Session - Ballroom A & B
Chair:
Dr. Kenneth Potocki, former Program Manager, Johns Hopkins University, Applied Physics Laboratory

DARPA Science & Technology Program
Dr. Kaigham (Ken) J. Gabriel, Deputy Director, Defense Advanced Research Projects Agency
- 2:15 PM – 5:00 PM **DoD Science & Technology Priorities Session**
General Session - Ballroom A & B
The ASD(R&E), with the support of the Services, Agencies and Joint Staff, led studies to identify the core capabilities and enabling technologies for each of the 6 QDR key mission areas. These studies were completed and identified near and long-term technology investments that will be required to contribute to success in these mission areas. The DoD Science & Technology (S&T) Executive Committee considered the results of these studies, along with Service S&T priorities, and the recommendations of DoD S&T Communities of Interest and DoD Technology Focus Teams, to develop a list of 7 DoD S&T Priorities. These 7 DoD S&T Priorities were documented in a memorandum signed by the Secretary of Defense on April 19, 2011. In this memorandum, the Secretary directed that implementation roadmaps be developed for each S&T Priority to coordinate the Department's investments in these priority areas. In this session, team leaders responsible for developing the implementation roadmaps will provide an update on the background, status, and the identification of the technology challenges associated with 4 of the 7 DoD S&T Priorities. The remaining 3 DoD S&T Priorities (Cyber Science and Technology, Counter Weapons of Mass Destruction, and Electronic Warfare/Electronic Protection) will be presented in the Classified Session on Thursday afternoon.
Co-Chairs:
▶ Dr. Jim Wasson, Vice President, Business Development, Bennett Aerospace
▶ Dr. Al Emondi, Deputy Chief Technology Officer, SPAWAR, Atlantic
- 2:15 PM – 2:30 PM **Process Used to Develop the DoD Science & Technology Priorities**
Mr. Robert W. Baker, Deputy Director, Plans & Programs, OASD(R&E)

CONFERENCE AGENDA

TUESDAY, JUNE 21, 2011

- 2:30 PM – 2:45 PM **A Message to Industry**
Ms. Matice Wright, Principal Director, Manufacturing and Industrial Base Policy, OUSD(AT&L)
- 2:45 PM – 3:15 PM **Data to Decisions**
Dr. Randy Avent, Chief Scientist, Basic Science Office, OASD(R&E)
- 3:15 PM – 3:45 PM **Networking Break**
Exhibit Hall - Exhibition Hall A
- 3:45 PM – 4:15 PM **Autonomy**
Dr. Bobby Junker, Head, C4ISR Department, Office of Naval Research
- 4:15 PM – 4:45 PM **Human Systems**
Dr. John F. Tangney, Director, Human & Bioengineered Systems Division, Office of Naval Research
- 4:45 PM – 5:15 PM **Engineered Resilient Systems**
Dr. Randy Avent, Chief Scientist, Basic Science Office, OASD(R&E)
- 5:15 PM – 6:30 PM **Networking Reception (Hosted Wine and Beer)**
Exhibit Hall - Exhibition Hall A

WEDNESDAY, JUNE 22, 2011

- 7:00 AM – 5:00 PM **Conference Registration**
Ballroom A & B Foyer
- 7:00 AM – 7:55 AM **Continental Breakfast**
Ballroom A & B Foyer
- 7:55 AM – 8:00 AM **Opening Remarks**
General Session - Ballroom A & B
Mr. James Chew, Director, Advanced Technologies & Concepts, L-3 Communications;
S&ET Division Chair
- 8:00 AM – 5:00PM **Services Sessions**
General Session - Ballroom A & B
The Military Departments play a major role in the planning and execution of the DoD S&T program. The Services provide the stable long-term part of the program, focused on their Services' responsibilities. The Service S&T communities are also constantly looking for opportunities to achieve revolutionary breakthroughs; however, they must also maintain a range of core competencies while also supporting the acquisition and logistics systems that produce and maintain military equipment. Each Service has a vision of future capabilities required to support the core competencies they are uniquely responsible for maintaining. In this session, Army, Navy, and Air Force Representatives will provide overviews of their S&T programs. They will also present on priority S&T programs in their portfolios that provide enabling technologies for core capabilities and support the DoD S&T Priorities.
- 8:00 AM – 10:00 AM **Army Science & Technology Program Session**
Co-Chairs:
► Dr. Walter F. (Rick) Morrison, Principal, Booz Allen Hamilton
► Mr. Jeff Singleton, Director for Basic Research, Office of the Deputy Assistant Secretary of the Army (Research & Technology)
- 8:00 AM – 9:00 AM **Providing Technology Enabled Capabilities**
Mr. Jeff Singleton, Director for Basic Research, Office of the Deputy Assistant Secretary of the Army (Research & Technology)

MRAP INTEGRATION FACILITY TOUR*

During the conference, there will be an optional MRAP Integration Facility Tour. The tour will take place on Wednesday, June 22 from 10:00 AM until 12:00 PM. The tour will walk through the MRAP Integration Facility with storyboards describing their processes and success stories. There are 50 vehicles in the facility for integration of electronic systems. To attend the tour, one must have already submitted a visit request. If you submitted a visit request for the Classified Session, you do not need to send another visit request. Tour attendance will be awarded on a first-come, first-served basis. To sign-up, please see the Conference Registration Desk.

- ▶ The Tour is limited to the first 50 Attendees who sign-up at the Conference Registration Desk
- ▶ Prior submittal of visit request required to participate
- ▶ Transportation will be provided

WEDNESDAY, JUNE 22, 2011

10:00 AM

Depart Charleston Convention Center;
En route to MRAP Integration Facility

10:30 AM

MRAP Integration Facility Tour

11:30 AM

Depart MRAP Integration Facility;
En route to Charleston Convention Center

QUESTIONS

Please contact Mr. James Polk at:
james.polk@navy.mil or (843)218-5699
with questions or concerns regarding the MRAP Integration Facility Tour.



Science | Technology | Engineering | Mathematics

WEDNESDAY, JUNE 22, 2011

9:00 AM – 9:45 AM

Providing Soldiers Strategic Technology Enablers
Dr. David Pittman, Director of the Geotechnical and Structures Laboratory, U.S. Army Engineer Research & Development Center, U.S. Army Corps of Engineers

9:45 AM – 10:00 AM

Question and Answer Session
Moderator: Dr. Walter F. (Rick) Morrison, Principal, Booz Allen Hamilton
▶ Dr. Marilyn M. Freeman, Deputy Assistant Secretary of the Army (Research & Technology)
▶ Dr. David Pittman, Director of the Geotechnical and Structures Laboratory, U.S. Army Engineer Research & Development Center, U.S. Army Corps of Engineers

10:00 AM – 12:00 PM
(Optional MRAP Tour)

MRAP Integration Facility Tour*
Off-site Location (See left column for details)

10:00 AM – 10:30 AM

Networking Break
Exhibit Hall - Exhibition Hall A

10:30 AM – 12:30 PM

The Naval Science & Technology Program Session
General Session - Ballroom A & B

Co-Chairs:

- ▶ Mr. Dennis L. Ryan, III, Science & Technology Planning Director, Johns Hopkins University, Applied Physics Laboratory
- ▶ Dr. Joseph Lawrence, III, Director of Transition, Office of Naval Research
- ▶ Mr. E. Terrence Dailey, Director for Transition, Carnegie Mellon University, Software Engineering Institute

10:30 AM – 11:15 AM

Overview of Naval Science, Technology, and Engineering

Dr. Joseph Lawrence, III, Director of Transition, Office of Naval Research

11:15 AM – 12:30 PM

Discussion on Navy and Marine Corps Technology Needs

Moderator: Dr. Joseph Lawrence, III, Director of Transition, Office of Naval Research

- ▶ Mr. Rob Wolborsky, Chief Technology Officer (CTO), SPAWAR
- ▶ Mr. Michael Bosworth, Acting Chief Technology Officer, Naval Sea Systems Command
- ▶ Ms. Rebecca Ahne, Deputy Chief Technology Officer, Naval Aviation Enterprise
- ▶ Mr. James H. Smerchansky, Deputy Commander Systems Engineering, Interoperability, Architectures, & Technology, Marine Corps Systems Command

12:30 PM – 1:30 PM

Networking Buffet Lunch
Exhibit Hall - Exhibition Hall A

CONFERENCE AGENDA

WEDNESDAY, JUNE 22, 2011

- 1:30 PM – 5:00 PM **Air Force Science & Technology Program Session**
General Session - Ballroom A & B
Co-Chairs:
▶ Mr. Michael C. Dudzik, Vice President, Science & Technology, Lockheed Martin
▶ Mr. Chris Clay, Deputy Division Chief, Science & Technology Division, Office of the Deputy Assistant Secretary of the U.S. Air Force for Science, Technology, and Engineering
- 1:30 PM – 2:15 PM **Overview of Air Force Science, Technology, and Engineering**
Colonel Mark Koch, USAF, Associate Deputy Assistant Secretary of the Air Force (Science, Technology & Engineering)
- 2:15 PM – 2:45 PM **High Velocity Penetrating Weapon (HVPW)**
Mr. Ron Taylor, Munitions Directorate, U.S. Air Force Research Laboratory
- 2:45 PM – 3:30 PM **Networking Break - Last Chance to Observe Exhibits and Poster Papers**
Exhibit Hall - Exhibition Hall A
- 3:30 PM – 4:00 PM **Responsive Reusable Booster for Space Access**
Mr. Bruce Thieman, Air Vehicles Directorate, U.S. Air Force Research Laboratory
- 4:00 PM – 4:30 PM **Precision Airdrop**
Dr. Keith Bowman, Air Vehicles Directorate, U.S. Air Force Research Laboratory
- 4:30 PM – 5:00 PM **IR&D Linkage to Service Core Functions**
Dr. James Malas, Plans & Programs Directorate, U.S. Air Force Research Laboratory
- 5:00 PM **Adjourn for the Day**

THURSDAY, JUNE 23, 2011

- 7:00 AM – 12:00 PM **Conference Registration**
Ballroom A & B Foyer
- 7:00 AM – 7:55 AM **Continental Breakfast**
Ballroom A & B Foyer
- 7:55 AM – 8:00 AM **Opening Remarks**
General Session - Ballroom A & B
Mr. James Chew, Director, Advanced Technologies & Concepts, L-3 Communications; S&ET Division Chair
- 8:00 AM – 12:00 PM **Capabilities Needed by the Combatant Commanders Session**
General Session - Ballroom A & B
Meeting the capability needs of the warfighter is the most important goal of the DoD Science & Technology program. Establishing strong communications between the warfighter and the researcher is essential for understanding these capability needs. Warfighters traditionally communicate their needs in terms of capability gaps. The DoD S&T community must be able to address those gaps in S&T projects and demonstrate how enabling technology can effectively fill these capability gaps. In this session, representatives of U.S. Combatant Commanders will describe what new operational capabilities would make a big difference in their ability to conduct military operations in their areas of responsibility.
Co-Chairs:
▶ Mr. James Chew, Director, Advanced Technologies & Concepts, L-3 Communications
▶ Dr. Joseph Lawrence, III, Director of Transition, Office of Naval Research

THURSDAY, JUNE 23, 2011

8:00 AM – 8:20 AM	How Capabilities are Developed and Delivered to the Combatant Commanders Mr. Robert W. Baker, Deputy Director, Plans & Programs, OASD(R&E)
8:20 AM – 8:40 AM	USCENTCOM Mr. Eric A. Follstad, Chief, Transformation & Concept Development, USCENTCOM
8:40 AM – 9:00 AM	USSOCOM Ms. Lisa Sanders, Deputy Director Science & Technology, USSOCOM
9:00 AM – 9:20 AM	USPACOM Mr. Ken Bruner, Science Advisor, USPACOM
9:20 AM – 9:40 AM	USSOUTHCOM Mr. Ricky Stuart, Technology Manager, USSOUTHCOM
9:40 AM – 10:00 AM	Networking Break <i>Ballroom A & B Foyer</i>
10:00 AM – 10:20 AM	USTRANSCOM Mr. Lou Bernstein, Chief, Future Capabilities & Technology, USTRANSCOM
10:20 AM – 10:40 AM	USSTRATCOM Mr. Dave Tyner, Science & Technology Advisor, USSTRATCOM
10:40 AM – 11:00 AM	USAFRICOM Mr. Mike Owens, Science & Technology Advisor, USAFRICOM
11:00 AM – 11:20 AM	USNORTHCOM Dr. Susanne Wirwille, Director, Science & Technology, NORAD and USNORTHCOM
11:20 AM – 11:40 AM	USEUCOM Mr. Stephen L. Spehn, Deputy Science Advisor, USEUCOM
11:40 AM – 12:00 PM	Best Poster Winner Announcement and Closing Remarks ► Mr. James Chew, Director, Advanced Technologies & Concepts, L-3 Communications; S&ET Division Chair ► Mr. Michael Liggett, Director Technology Programs, Raytheon Company
12:00 PM	Conference Adjourned and Boxed Lunch Served

Classified Session Badge Pick-Up Desk Hours

DO NOT FORGET TO PICK-UP YOUR CLASSIFIED SESSION BADGE! ALL CLASSIFIED SESSION ATTENDEES MUST HAVE A CONFERENCE BADGE, A CLASSIFIED BADGE AND A VALID PHOTO ID TO ATTEND THE SESSION.

TUESDAY, JUNE 21, 2011

7:00 AM – 8:00 AM
9:45 AM – 10:15 AM
2:45 PM – 3:30 PM

WEDNESDAY, JUNE 22, 2011

7:00 AM – 8:00 AM
10:00 AM – 10:30 AM
3:30 PM – 4:00 PM

THURSDAY, JUNE 23, 2011

7:00 AM – 8:00 AM
9:30 AM – 10:10 AM
12:10 PM – 12:45 PM

CLASSIFIED SESSION AGENDA

General Session - Ballroom A & B

THURSDAY, JUNE 23, 2011

1:00 PM – 5:15 PM

Classified Session

Off-site Location: SPAWAR's facility on Base

Registered NDIA S&ET Conference Attendees are invited by OASD(R&E) and SPAWAR to attend a Classified Session held off-site. Classified Session Attendees must hold a Secret Level Classification and must have previously submitted and verified their clearance acceptance with the SPAWAR security office by Friday, June 10, 2011. **Classified Session Attendees must have a valid ID and a Classified Issued Badge to attend this Session.**

Co-Chairs:

- ▶ Dr. Al Emondi, Deputy Chief Technology Officer, SPAWAR, Atlantic
- ▶ Mr. James Chew, Director, Advanced Technologies & Concepts, L-3 Communications; S&ET Division Chair

1:00 PM – 1:30 PM

Classified Session Attendees Proceed to Off-Site Location

Bus Transportation to the Classified Session Provided; WILL START AT 1:00 PM SHARP

Front Drive

1:30 PM – 2:00 PM

Operate Effectively in Cyberspace

Dr. Steven King, Deputy Director for Cyber Security Technology, OASD(R&E)

2:00 PM – 2:30 PM

Counter Weapons of Mass Destruction (WMD)

Dr. Carol Kuntz, Senior Advisor, Office of the Assistant Secretary of Defense for Nuclear, Chemical and Biological Defense Programs

2:30 PM – 3:00 PM

Electronic Warfare/Electronic Protection

Dr. Peter Craig, Electronic Warfare Program Manager, Office of Naval Research

3:00 PM – 3:15 PM

Networking Break (Refreshments not provided)

3:15 PM – 3:35 PM

USSTRATCOM

Mr. Dave Tyner, Science & Technology Advisor, USSTRATCOM

3:35 PM – 3:55 PM

USSOCOM

Ms. Lisa Sanders, Deputy Director Science & Technology, USSOCOM

3:55 PM – 4:15 PM

USCENTCOM

Mr. Eric A. Follstad, Chief, Transformation & Concept Development, USCENTCOM

4:15 PM – 4:35 PM

USPACOM

Mr. Ken Bruner, Science Advisor, USPACOM

4:35 PM – 4:55 PM

USNORTHCOM

Dr. Susanne Wirwille, Director, Science & Technology, NORAD and USNORTHCOM

4:55 PM – 5:15 PM

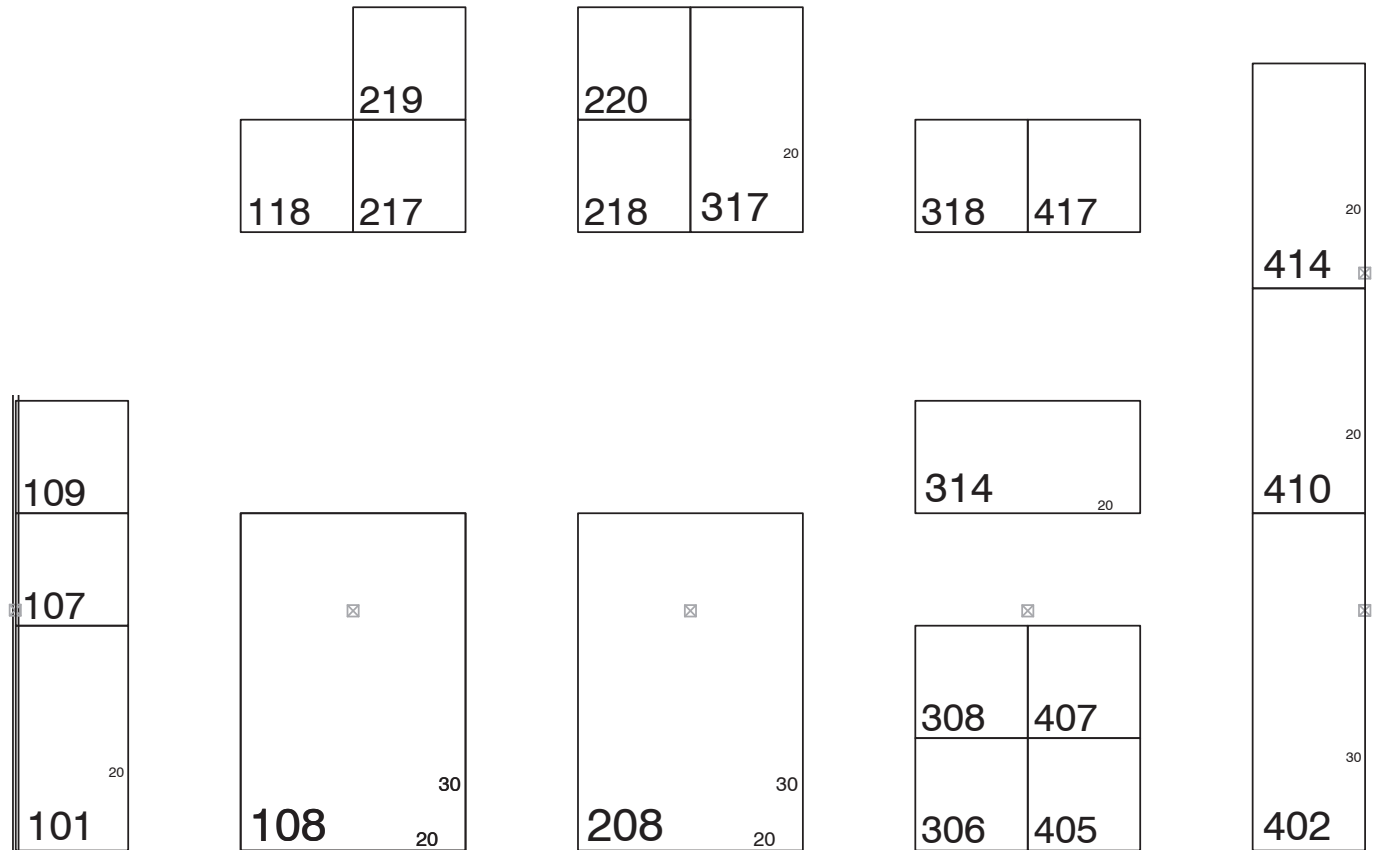
USSOUTHCOM

Mr. Ricky Stuart, Technology Manager, USSOUTHCOM

5:15 PM

Classified Session Adjourned and Return Bus Service

EXHIBIT HALL FLOOR PLAN



EXHIBITING AS

Aeros Aeronautical Systems
Aurora Flight Sciences
Bennett Aerospace, Inc.
Biometrics Identity Management Agency
Center for Organic Photonics and Electronics
Dassault Systemes Americas Corp.
Defense Microelectronics Activity-DMEA
DHS Science & Technology Directorate
Edgewood Chemical Biological Center
Global Staffing and Consulting, LLC
L-3 Communications - Interstate Electronics Corp.
NDIA - STEM
Scientific Research Corporation
Space and Naval Warfare Systems Center Atlantic
Test Resource Management Center
Torrey Pines Logic
U.S. Air Force Research Lab
U.S. Army Corp of Engineers, ERDC
U.S. Army RDECOM ARDEC
U.S. Army RDECOM ARL

BOOTH NUMBER

218
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402

EXHIBITOR PROFILES

Booth # - 218

Aeros Aeronautical Systems

Aeros is the world's leading lighter-than-air, FAA-certified aircraft manufacturing company. The company's operations involve the research, development, production, operation and marketing of a complete family of Aeros-branded air vehicles used in government and commercial applications. These include non-rigid FAA Type Certified Aeros 40D Sky Dragon Airships, Advanced Tethered Aerostatic Systems and New Type Rigid Air Vehicle - Aeroscraft.

Booth # - 317

Aurora Flight Sciences

As a leader in the unmanned aircraft systems technology for over 20 years, Aurora Flight Sciences is engaged in the design, development, production, and support of unmanned aircraft. Aurora works closely with academia, the Service laboratories, DARPA, and NASA to demonstrate innovative solutions for our warfighter. As an example, the 5-day endurance Orion UAS was selected for the CENTCOM sponsored MAGIC JCTD in August 2010.

Booth # - 220

Bennett Aerospace, Inc.

Bennett Aerospace is a small business and a high-end, highly technical, engineering and development company based in Cary, North Carolina. The company's core capabilities are in:

- Optics and Lasers: Holographic Visualization; Tunable Lasers; Fiber Lasers
- Sensor and Instrumentation Development: Lidar Systems; Phased Array Radar
- Space Hardware: Communications; Navigation; Strategic Assessments
- Robotics: System Design and Build; Shipboard Robotics
- Communications: System and Component Design; Terrestrial and Space
- Materials and Manufacturing: Additive Manufacturing; Nano-Scale High-Strength Fiber; Advanced Materials; Nano-scale Piezoelectrics

Booth # - 107

Biometrics Identity Management Agency

The Biometrics Identity Management Agency (BIMA) leads Department of Defense activities to program, integrate, and synchronize biometric technologies and capabilities. BIMA collaborates with stakeholders and the biometric community to lead in the development of biometric capabilities that empower the warfighter.

Booth # - 109

Center for Organic Photonics and Electronics

The Georgia Tech Center for Organic Photonics and Electronics (COPE) is a leading research and educational resource center that creates flexible organic photonic and electronic materials and devices that serve the information technology, telecommunications, energy, and defense sectors.

Booth # - 306

Dassault Systemes Americas Corp.

As a world leader in 3D and Product Lifecycle Management (PLM) solutions, Dassault Systèmes develops and markets PLM application software and services that support the defense industry's industrial processes and provide a 3D vision of the entire lifecycle of products. Solutions include: Integrated product design, realistic simulation, virtual production, global collaborative innovation and 3D lifelike experience.

Booth # - 217

Defense Microelectronics Activity-DMEA

DMEA is a vital national asset as the joint DoD Center for microelectronics acquisition, adaptive operations and support--advancing future microelectronics research, development, technologies and applications to achieve the DoD's strategic and national security objectives.

Booth # - 318

DHS Science and Technology Directorate

DHS Science and Technology Directorate's mission is to provide our customers, DHS operating components, and their customers who secure our borders, ports and skies, with advanced capabilities to protect and serve the public. The S&T Directorate manages an integrated research and development program that enables technology for a safer nation.

Booth # - 414

Edgewood Chemical Biological Center

The U.S. Army Edgewood Chemical Biological Center is the nation's principal R&D resource for non-medical chemical biological defense. ECBC supports all phases of the acquisition lifecycle from basic and applied research through technology development, engineering design, equipment evaluation, product support, sustainment, field operations and demilitarization to address unique customer requirements.

Booth # - 405

Global Staffing and Consulting, LLC

GSAC, Global Staffing and Consulting, LLC, services clients in government and commercial organizations with contract, permanent and consulting professionals and executives. GSAC's areas of expertise include: Accounting, Aerospace, Audit, Capture, Compliance, Contracts, Government Relations, Engineering, Financial, Healthcare, Information Technology, Legal, Logistics, Proposals, Capture, and Procurement professionals.. Visit GSAC at www.gsacgroup.com or call 301-760-6802. Bethesda, MD & Washington, DC

EXHIBITOR PROFILES

Booth # - 219

L-3 Communications - Interstate Electronics Corp.

L-3's Precision Engagement Sector consists of the following divisions; Interstate Electronics Corporation, Fusing and Ordnance Systems, Unmanned Systems and Airborne Technologies, Inc. These businesses provide a broad range of products, including components, subsystems and systems, to military and commercial customers. Offerings include Unmanned Aircraft, Guidance & Navigation, Command & Control, Situational Awareness, Fusing and Ordnance, and Systems Integration.

Booth # - 108

NDIA - STEM

NDIA's Science, Technology, Engineering and Mathematics (STEM) Workforce Division provides a forum for effective interaction between government, industry, academia, and the public at large for the strengthening of the national security STEM workforce. The Broad goals of the Division are to

- Increase NDIA's participation in exciting and attracting K-12 students into STEM careers.
- Maximize cooperation between federal departments, agencies, and industry on STEM workforce development initiatives.
- Support the development of integrated policies around the STEM workforce.
- Establish partnerships to collect and disseminate information and coordinate resources to build a robust STEM workforce of the future.

Booth # - 314

Scientific Research Corporation

The T&E/S&T Program continues to develop test technologies for transition into future test capabilities that will verify and support to optimization of the warfighting performance of our most advanced warfighting systems. These systems include advanced propulsion systems, directed energy weapons, multi-spectral sensors, net-centric systems, and unmanned systems.

Booth # - 101

Space and Naval Warfare Systems Center Atlantic

SPAWAR Systems Center Atlantic is a Department of the Navy engineering laboratory focused on rapidly developing and delivering secure, integrated and innovative solutions for our naval, joint, national and coalition warfighters. Aligned with the CNO's vision of adding cyber power to the already proven arsenal of sea and air power, SPAWAR Systems Center Atlantic provides end-users with a critical edge, elevating Information Dominance as a core warfighting capability.

Booth # - 407

Test Resource Management Center

The T&E/S&T Program continues to develop test technologies for transition into future test capabilities that will verify and support to optimization of the warfighting performance of our most advanced warfighting systems. These systems include advanced propulsion systems, directed energy weapons, multi-spectral sensors, net-centric systems, and unmanned systems.

Booth # - 308

Torrey Pines Logic

Torrey Pines Logic provides research, design, development and custom solutions using visible and IR sensors, lasers, image processing and analysis, wireless and IR-based communications, computer graphics and video.

(As of 6/09/2011)

Booth # - 208

U.S. Air Force Research Lab

AFRL displays the latest Air Force technologies in directed energy, human systems, information management, materials and manufacturing, munitions, propulsion, sensors, air vehicles, space vehicles, and basic research. AFRL executes the Air Force's entire science and technology budget. We partner with government, industry and academia to accomplish this mission.

Booth # - 417

U.S. Army Corp of Engineers, ERDC

The U.S. Army Engineer Research and Development Center (ERDC) is one of the most diverse engineering and scientific research organizations in the world. The ERDC conducts R&D in support of the Soldier, military installations, and the Corps of Engineers civil works mission, as well as for other federal agencies, state and municipal authorities, and with U.S. industry through innovative work agreements. ERDC's unique research capabilities and facilities have earned it distinction as the "Army Large Research Laboratory of the Year" for 10 of the last 19 years. As the world's premier engineering and environmental sciences organization, ERDC's cutting-edge technology is solving problems that others are not attempting to tackle in an effort to make our world safer and better.

Booth # - 402

U.S. Army RDECOM ARL

The U.S. Army Research, Development and Engineering Command (RDECOM) is the Army's technology leader and largest technology developer. RDECOM ensures the dominance of Army capabilities by creating, integrating and delivering technology-enabled solutions to our Soldiers. To meet this commitment to the Army, RDECOM develops technologies in its eight major laboratories and research, development and engineering centers. The U.S. Army Research Laboratory is the Army's corporate, or central, laboratory. Its diverse assortment of unique facilities and its workforce of government engineers and scientists comprise the largest source of world class integrated research and analysis in the Army. ARL's programs consist of basic and applied research and survivability/lethality analysis. One of the centers, the Armaments Research, Development & Engineering Center has the mission to develop and maintain a world-class workforce to execute and manage integrated life cycle engineering processes required for the research, development, production, field support and demilitarization of munitions, weapons, fire control and associated items.

Booth # - 410

U.S. Army RDECOM ARDEC

ARDEC is an internationally acknowledged hub for the advancement of armaments technology and engineering innovation. Our mission is to develop, maintain, execute and manage integrated life cycle engineering processes required for the research, development, production, field support and demilitarization of munitions, weapons, fire control and associated items.

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Missouri University of Science & Technology

Brig Gen Buck Adams, USAF (Ret)
Booz Allen Hamilton

Mr. Jack Adams
Calgon Carbon Corporation

Dr. Laura Adolfie
OSD STEM Development Office

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Iowa State University

Ms. Becky Ahne
Naval Aviation Systems Command

Mr. Steve Alexander
L-3 Communications

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Defense Acquisition University

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Mr. Kevin Charlow
SPAWAR

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Northrop Grumman Corporation

Mr. James Chew
L-3 Communications

Mr. Henry Choi
Northrop Grumman Corporation

Mr. Mike Ciesinski
FlexTech Alliance

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Clark Defense Consulting

Mr. Christopher Clay
SAF/ AQRS

Ms. Christa Cochran
OSD

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The Boeing Company

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Joint Program Executive Office Chemical
Biological Defense

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AT

Mr. Gregor Doerrer
NSWC Carderock

LTC Bob Domenici, USA (Ret)
Strategic Response Initiatives, LLC

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USCENTCOM

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BAE Systems

Dr. John Frim
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TSS

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Mr. Rahul Harish
Wayne State University

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Research Directorate

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U.S. Air Force Intelligence, Surveillance & Reconnaissance Agency

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Worldwide Aeros Corporation

Mr. Kim Jones
U.S. Army RDECOM - ARDEC

Dr. Walter Jones
Office of Naval Research

Dr. Bobby Junker
Office of Naval Research

MG Nick Justice, USA
U.S. Army

BG Jim Kays, USA (Ret)
Naval Postgraduate School

Ms. Trish Keaton
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Defense Research & Engineering

Mr. Dan Letbetter
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USPACOM

LTC Joe Lofgren, USA (Ret)
Raytheon Company

Mr. Dave Lohman
Biometrics Identity Management Agency

Dr. Margaret Loper
Georgia Tech Research Institute

LT John Lorentz, USCG (Ret)
Command Decisions Systems and Solutions

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DoD-OUUSD(AT&L)

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Naval Sea Systems Command

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Dassault Systemes of America Corp.

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Rockwell Collins

MCPO Charles Ziervogel, USN
Office of Naval Research

Mr. Jim Zimmer
Barling Bay, LLC

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2111 WILSON BOULEVARD
SUITE 400
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(703) 522-1885 FAX
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Thank You for Attending!
We'll See You in 2012!

SAVE THE DATE

13th Annual S&ET Conference DoD / Tech Exposition

April 17 - 19, 2012

Charleston Convention Center, North Charleston, SC

<http://www.ndia.org/meetings/2720>



Naval Aviation Enterprise Chief Technology Officer (CTO) Organization

Ms. Rebecca Ahne, NAE Deputy CTO

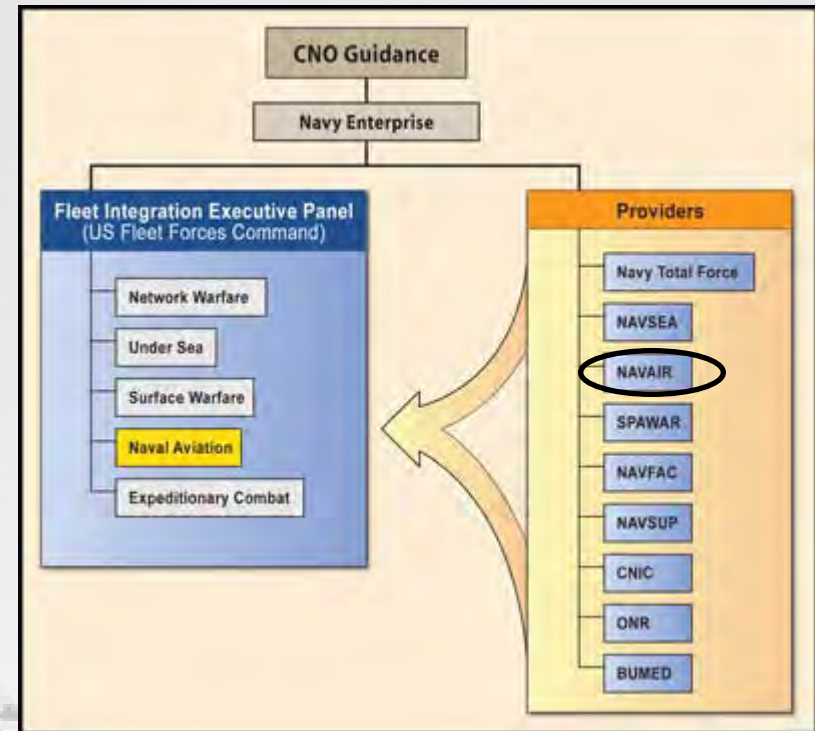




Naval Aviation Enterprise



The Naval Aviation Enterprise (NAE) is a warfighting partnership in which interdependent Naval Aviation issues affecting multiple stakeholders are resolved on an enterprise-wide basis. Between the Navy and Marine Corps, our Enterprise includes over 183,000 people, 3,700 aircraft, 11 aircraft carriers and executes a budget in excess of \$40 billion. Focusing these resources to provide our country with the necessary warfighting readiness expected to meet national policy and priorities is a shared responsibility of each member of the Enterprise.



NAE CTO also serves as the CTO for

- Naval Air Systems Command (NAVAIR) and PEOs
- Naval Air Warfare Centers (NAWC)



Naval Aviation Platforms/Programs

ASN (RD&A)

ASSISTANT SECRETARY OF THE NAVY
(RESEARCH, DEVELOPMENT & ACQUISITION)

CNO

CHIEF OF NAVAL OPERATIONS

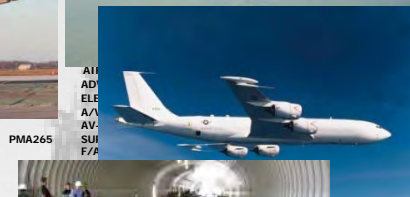
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JOINT STRIKE
FIGHTER



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PROGRAMS

PMA213



T-44
T-2
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T-39
TC-12

**FLEET SUPPORT
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AIR ASW,
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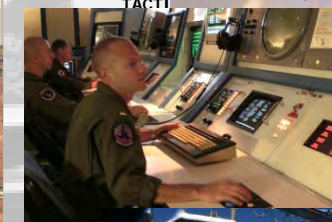


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STRIKE WEAPONS &
UNMANNED AVIATION

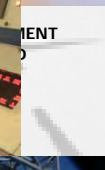


**COMMANDER,
NAVAL AIR SYSTEMS
COMMAND**

AIR-1.0



NAVAL AVIATION
ENTERPRISE

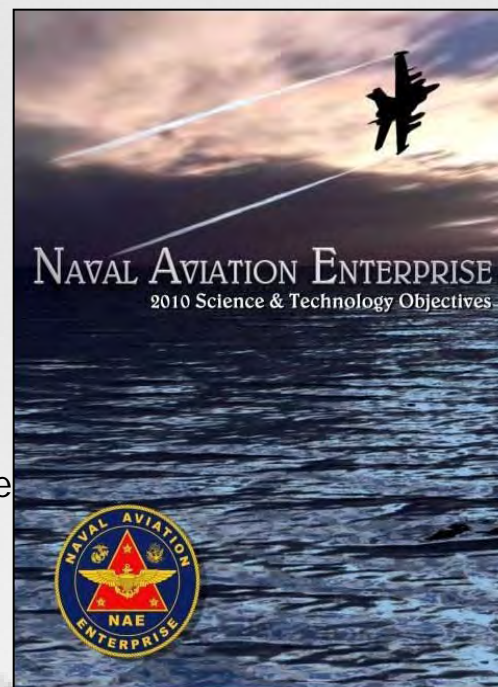




NAE Science & Technology Objectives




- Provides guidance for the NAE to facilitate the alignment of available science and technology development investments with the technology requirements of Naval aviation.
- Represents the goals of the NAE S&T program
 - Used as the baseline for identifying, prioritizing, aligning and synchronizing S&T investment efforts throughout the Enterprise.
- Represents a broad strategy that provides focused direction for the future while retaining sufficient flexibility to allow the S&T community to meet emerging challenges.
- Identifies 11 Capability Gaps supported by 34 NAE S&T Objectives (STOs)
 - USMC Aviation STOs included
- Document signed by
 - Commander, Naval Air Forces
 - Deputy Commandant for Aviation
 - Commander, Naval Air Systems Command
 - Director, Air Warfare
- Updated biennially; next edition available April 2012




Naval Aviation Enterprise
Science and Technology Objectives

April 2010


VADM Thomas J. Kildine, Jr., USN
Commander, Naval Air Forces


LtGen George J. Trahan III, USMC
Deputy Commandant for Aviation


VADM Daniel J. Vreese, USN
Commander, Naval Air Systems Command


RADM David L. Phillips, USN
Director, Air Warfare

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Available online at: <http://www.public.navy.mil/airfor/nae/Documents/2010%20STO.pdf>



S&T Objective Road Mapping

◆ 4 Levels of Road mapping

- Acquisition* – Defines capability needs specific to each platform and maps/aligns with POM cycles
- Platform S&T – Identifies where S&T can contribute to the needs identified on the Acquisition roadmap, identifies and maps current workload/projects to those needs
- S&T Objectives – Defines the critical capability gaps for each S&T Objective, decomposes capabilities needs into technology investment areas, identifies & maps current workload/projects, and identifies where future work may be required to achieve required capability
- Laboratory Core Capabilities – Defines those technologies considered core to the NAWC laboratory research and engineering workforce and facilities, maps current workload/projects and identifies where future work is required

* Acquisition Road maps are being developed by Program Offices



Deploy and Employ Forces (DEF) STO 3


- **STO Number:** DEF STO 3
- **Title:** Improved Vertical Delivery – Systems enhancements
- **Statement of Need:** Vertical delivery systems enhancements that improve ability to operate in the intended environment are required to increase tactical effectiveness, safety and survivability. Includes aerial delivery and internal/external cargo handling systems.
- **Why Required:** Military success is often dependent on a commander's ability to effectively maneuver and mass forces, to support and reinforce deployed or embarked units, and to quickly react to changes in the tactical situation. Additionally, Naval forces rely heavily on efficient, effective vertical lift for resupply and sustainment.

METRICS	Baseline	0-5 Years	5-10 Years	15+ Years
INCREASE SITUATIONAL AWARENESS	<div><div>Class 1</div><div>Class 2</div><div>Class 3</div><div>Class 4</div></div> <div>Type A- Fully Coupled Flight Control Augmentation Type B- Uncoupled Flight Control Augmentation</div>	Aircraft state sensors (e.g., GPS/INS) and cockpit displays provide additional piloting cues and improved situational awareness.		
SA Enablers (Sensors)		Display of digital terrain and aircraft self-reports for improved situational awareness. (Primarily for en-route phase)		
Data Fusion		Near real-time situational awareness of ground-based obstacles and terrain. "See and Remember" sensors; synthetic vision.		
Displays		Real-time situational awareness of stationary and mobile obstacles including nearby aircraft and terrain. "See Through" sensors; enhanced vision.		
Redistribution of Downwash				
EMBARK/DEBARK				
Reduce time to Embark (Full Payload)		10%	20%	30%
Reduce time to Debark (Full Payload)		10%	20%	30%
SPEED (External Loads)				
Increase speed for Ext Loads				
Helicopter		10%	25%	50%
Tiltrotor		10%	25%	50%
Unmanned Vertical Replenishment			Demonstrated	Deployed
DEVELOP SAFETY SYSTEMS				
Airframe/Crew Airbags				
Improve Crashworthiness Seats/Structure				
IMPROVE SURVIVABILITY				
Susceptibility				
Vulnerability				
Active Protection Systems				



DEF STO 3 - Taxonomy



Improve Active Protection Systems		
		Task Name
1		DEF STO 3 - SYSTEMS ENHANCEMENTS
2		
3		<input type="checkbox"/> IMPROVE SITUATIONAL AWARENESS (Brownout/Whiteout/Fog/Rain)
4		<input type="checkbox"/> Redistribution of Rotorwash/Flow Field Modification
11		<input type="checkbox"/> Develop "See Thru" Technologies
37		<input type="checkbox"/> Develop Tactile Cueing Systems
39		<input type="checkbox"/> Develop Terrain/Obstacle/Traffic Warning Systems
42		<input type="checkbox"/> Develop Improved Flight Controls
49		
50		<input type="checkbox"/> IMPROVE EMBARK/DEBARK TIMES
51		Reduce Embark Time
52		Reduce Debark Time
53		
54		<input type="checkbox"/> IMPROVE EXTERNAL LOAD CARRYING CAPABILITY
55		Increase Speed for external loads
56		<input type="checkbox"/> Develop Autonomous or Unmanned Vertical Replenishment Capability
58		
59		<input type="checkbox"/> IMPROVE SAFETY
60		<input type="checkbox"/> Develop Crashworthy Systems
69		<input type="checkbox"/> Develop Floatation & Stability Systems
71		
72		<input type="checkbox"/> IMPROVE SURVIVABILITY
73		<input type="checkbox"/> Suceptability
77		<input type="checkbox"/> Reduce Vulnerability
84		<input type="checkbox"/> Improve Active Protection Systems



DEF STO 3: See "Thru" Solution for Degraded Visual Environment



H-53 Upgrades

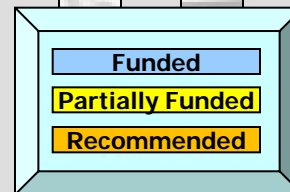
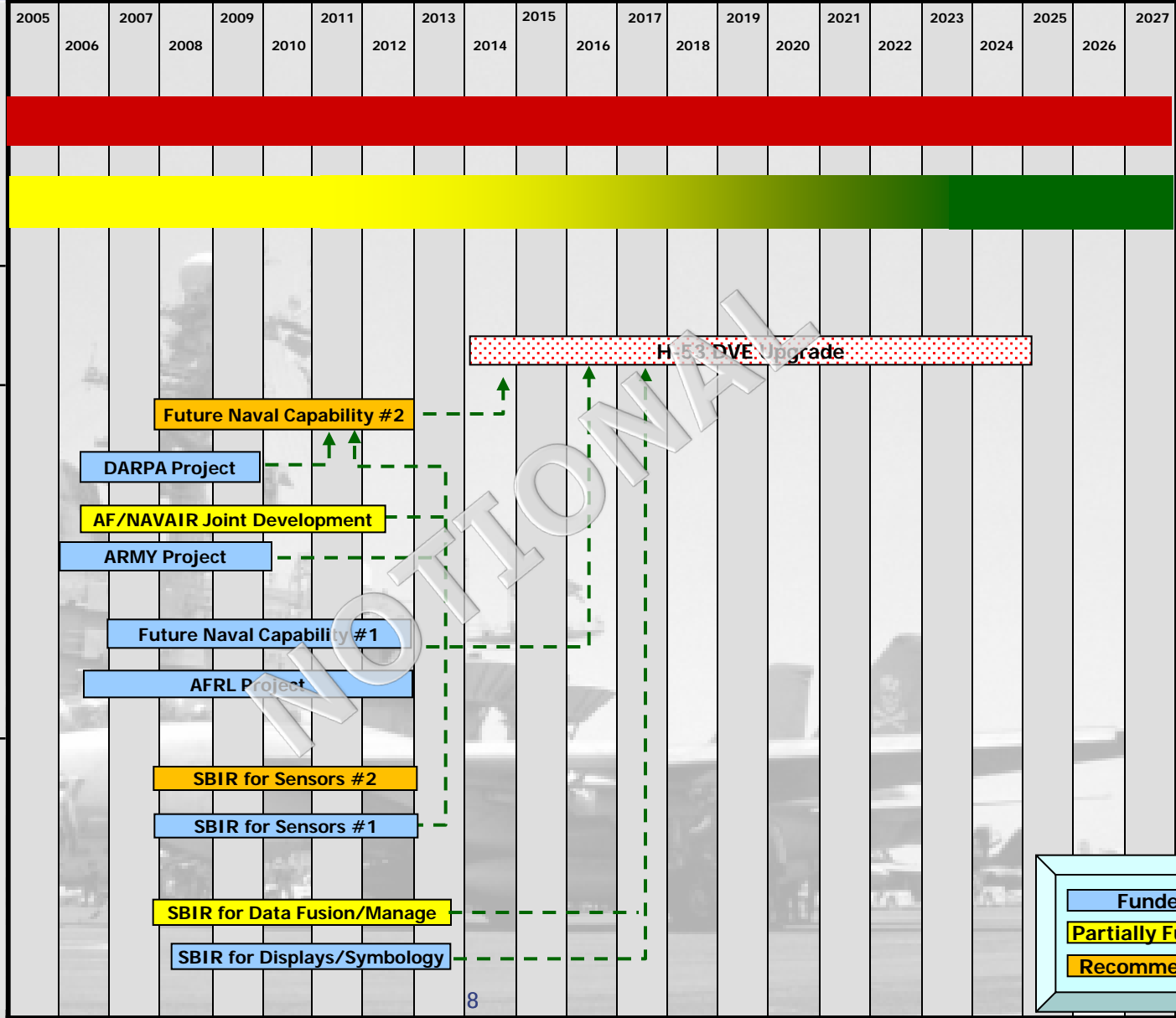
POR

ROAD
MAP

Acquisition

Technology Maturation (TRL 4-6)

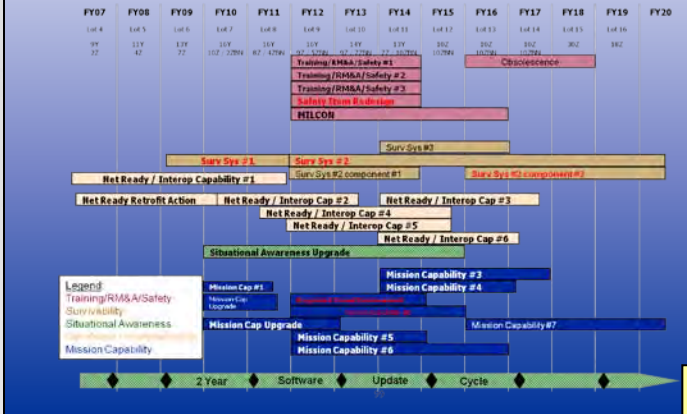
Science & Technology (TRL 1-4)





GOAL: Combined S&T/Acquisition

Rotary Wing Acquisition Roadmap (Example)





Summary



- ◆ NAE Chief Technology Officer (CTO) is responsible for providing oversight and strategic management of the NAE S&T investment portfolio
- ◆ NAE CTO monitors health of S&T portfolio and progress toward delivery of capability through the use of S&T Objective Roadmaps
- ◆ Goal is to integrate/link S&T Objective Roadmaps into Acquisition Roadmaps
 - Allows insight into our programs and provides a strategic framework for all stakeholders

Rebecca Ahne
NAE Deputy CTO
rebecca.ahne@navy.mil
(301) 342-1032



Centennial of Naval Aviation 1911-2011

**Thank you for your support
and celebration of the
United States Sea Services!**



DoD's Engineered Resilient Systems (ERS) S&T Priority

PoC: Dr. Robert Neches

**Director, Advanced Engineering Initiatives
ODASD - SE**

Robert.Neches@osd.mil

Presenter: Dr. Randy Avent

**Presentation to NDIA/DoD Annual S&T Conference
20-23 June 2011**



A Quote from the former Secretary of Defense, Dr. Robert Gates



The Honorable Dr. Robert M. Gates,
22nd Secretary of Defense, interview at
The American Enterprise Institute,
carried on CSPAN, 24 May 2011

...our record of predicting where we will use military force since Vietnam is perfect. We have never once gotten it right.

There isn't a single instance ... where we knew and planned for such a conflict six months in advance, or knew that we would be involved as early as six months ahead of time.

So my mantra actually has been for the last several years in the department that, as we train and as we equip, we need to have in mind the greatest possible flexibility and versatility for the broadest range of conflict....



Engineered Resilient Systems Problem Statement



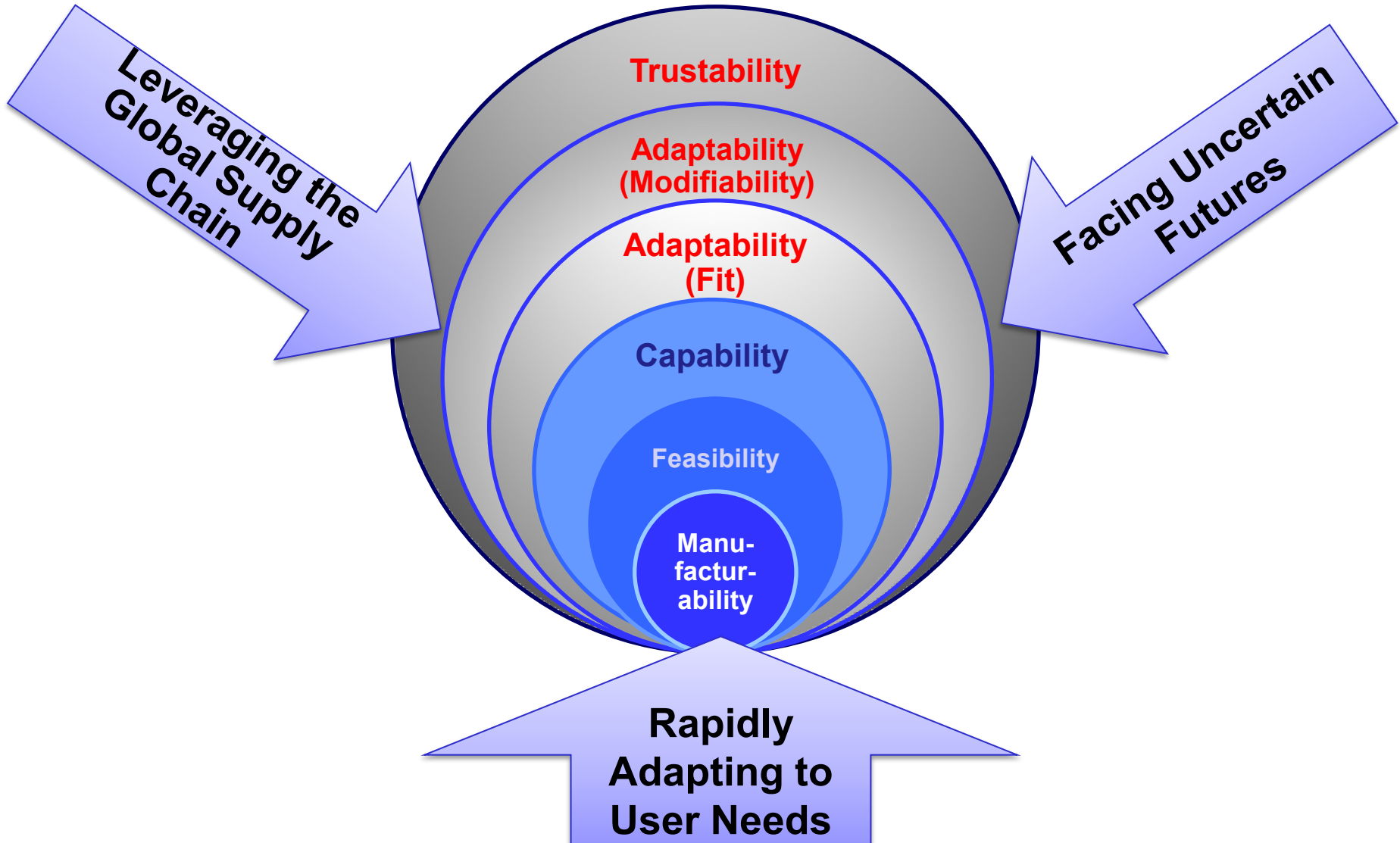
Uncertain futures & threats outpace our ability to create & field affordable, effective systems

Change happens – we need to design for it.
But, today, instead...

- **Adaptability, trustability and affordability are not sufficiently considered** when making tradeoffs
 - ...and are also not maintained when modifications occur during design, manufacturing, and fielding
- **Effective design is hobbled:** engineers hear too little about warfighters' / stakeholders' needs; and too little information about design feasibilities and opportunities gets fed back
- **Cost/schedule slip is highly likely when problems arise, requirements change, or adaption is needed:** Too few alternative designs are considered in depth, nor are they kept active very long
- **Uncertainties compound when planning horizons grow:** long design-test-build-field-adapt lead-times exacerbate uncertain futures problems, overload designs, and lock out new technologies



21st Century Dynamics Require New Design Constraints





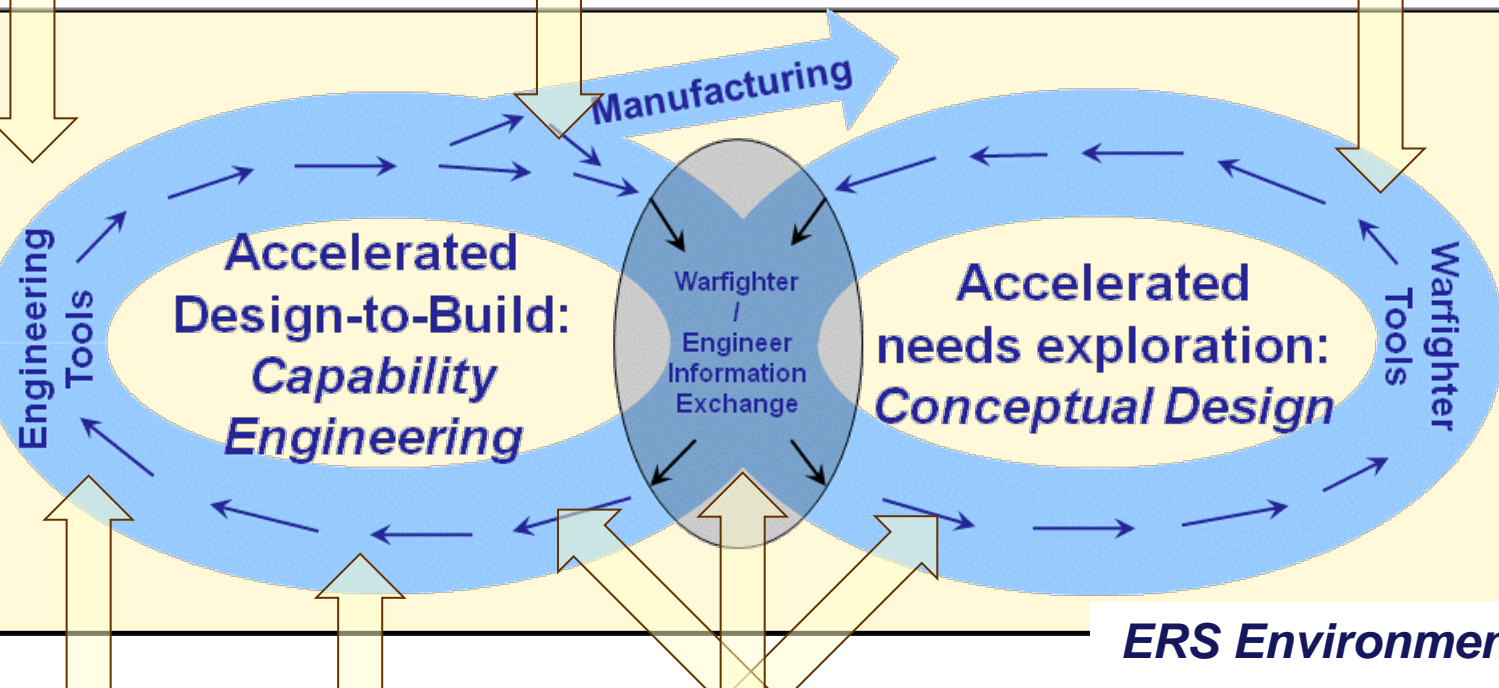
ERS: Tools and Technologies to Facilitate Adaptability & Trustability

ERS Technology Toolbox

1. Trustability: design patterns, analytic tools

4. Tying design, physical and computational testing

6. Instrumented virtual and live environments



2. Platform-Based analysis & architecting

3. Model-Based tools: analysis and simulation

5. Tradespace exploration

ERS Technology Toolbox



Goals / End States

Engineering of Defense Systems Capable of Supporting Rapidly Changing Warfighter Needs



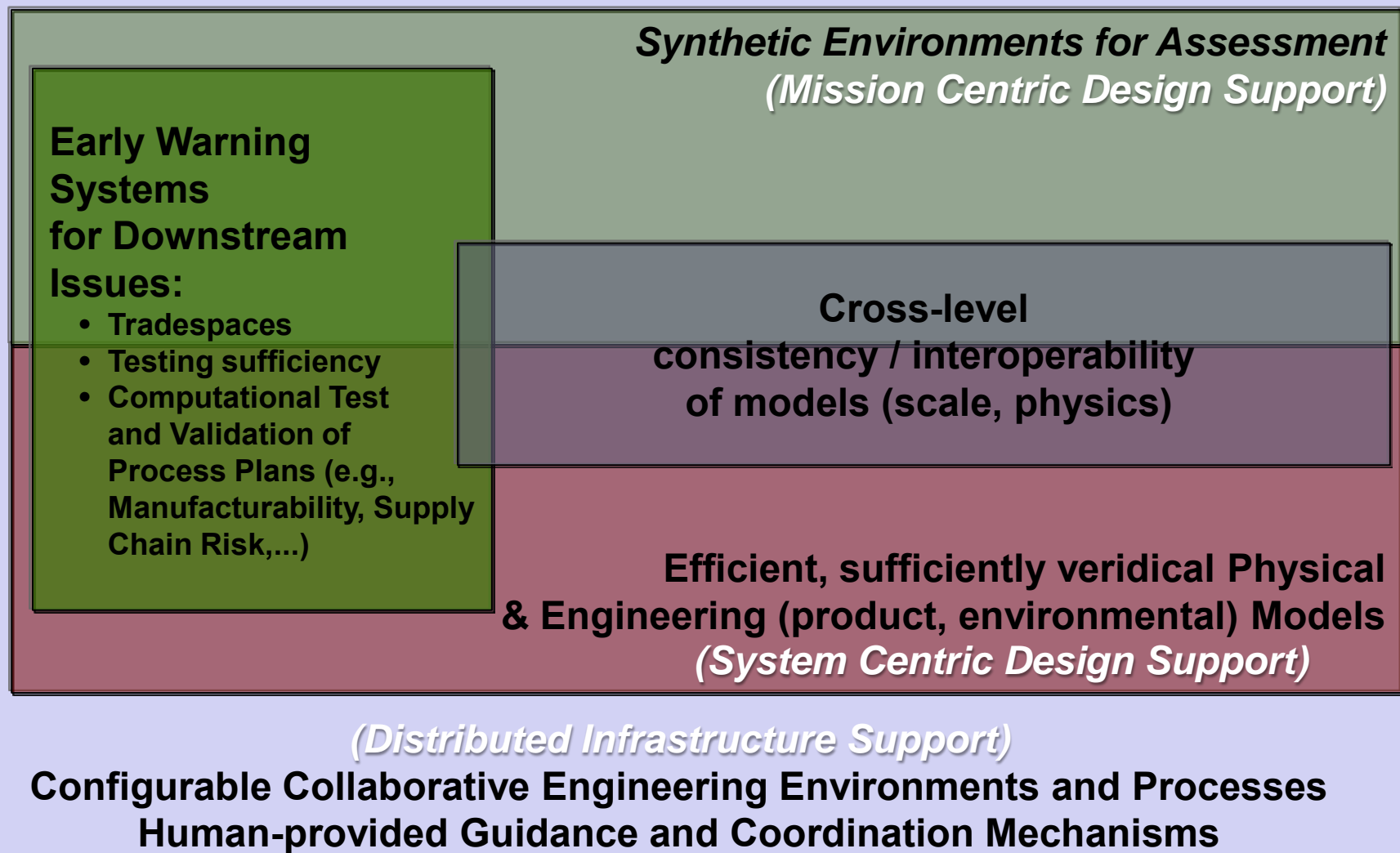
R&D in ERS enables agile and cost effective design, development, testing, manufacturing, and fielding of trusted, assured, easily modified defense systems

ERS delivers science, engineering concepts, processes, and design tools to:

- **Continuously coordinate design, testing, and production with warfighter review to facilitate earliest possible safe field use of needed capabilities**
- **Generate an efficient set of design points spanning the design space**
- **Ensure that tradeoffs among alternative designs are better understood, and that tradeoffs bearing on time, cost, trust and adaptability get appropriate consideration**
- **Facilitate adaptability via both reconfigurable product families and design diversity**
- **Consider a wide range of conditions and ConOps during design and testing**
- **Protect against unintentional or malicious compromise of weapon systems through the supply chain**
- **Reduce the time needed to reconfigure, substitute or otherwise adapt systems to rapidly changing conditions or operational concepts**
- **Provide a distributed collaborative engineering environment with seamless two-way transfer of data between tools enabling design, engineering, production/manufacturing, and operational evaluation**



Enabling Technologies for Making Informed Decisions about Systems Designed for Trustability and Adaptability – with Timely and Affordable Results





Emerging Technical Opportunities



1. Trustability: design patterns and tools *Adapt/extend reliability-inspired methods*

- Integrating reliability and cost approaches
- Reasoning about risk and uncertainty
- New sensitivity localization algorithms

2. Platform-Based analysis & architecting: *New analysis tools for designing platforms, rapidly adapting systems*

- Identifying high-impact variables, and likelihoods of emergent interactions
- Algorithms for measuring adaptability
- Risk-based cost-benefit analysis tools for platforms and designs, “uncertainty bars”

3. Model-based tools: analysis & simulation *New products / product line options*

- On-demand composition of models and simulation/analysis workflows
- Maintaining consistency across hybrid models (not unintelligible monolithic models)
- Using semantic features to create and repair mappings between modeling systems

4. Tying design, physical/computer tests *Linked temporal & physical models*

- Simulations combining live and virtual elements
- Acquisition and cross-integration of physics-based vs. statistical models
- Critical new models: e.g., deformable and moving objects

5. Tradespace exploration: *Collaborative options exploration*

- Guiding automated searches
- Advanced algorithms and massive computing for exploring alternative options
- Envisionment of multi-dimensional tradespaces

6. Instrumented live and virtual environments for ConOps Exploration

- Game and scenario writing tools
- Discussion, annotation, collaboration in augmented reality environments
- Visualization and explanation tools to assist in prioritizing tradeoffs, explaining decisions



Basic Science Issues

- **Scale and Complexity mean that humans cannot do the job unassisted**
 - Algorithms for selective search of intractably large spaces are needed to manage the combinatorial explosion
 - Human-guided search, and social networking techniques will also play a role
- **New challenges for large distributed architectures**
 - Efficient execution and coordination of large processing that is widely distributed and highly stochastic but partly parallel
- **New technology of interchange between discrete event, process and mathematical models will be needed to further manage tractability**
 - Models will need to be learned and refined from instrumenting physical tests and live systems
- **New human interface tools and approaches for decision support**
 - How do we help people understand the extent of coverage of mission possibilities?
 - How do we help people understand impact of requested design features/properties/capabilities and their interactions on affordability, delivery time, cost, and mission range?
- **New mathematical and statistical approaches to testing complexity and model validation**
 - Uncertainty representation and analysis (risk and confidence intervals)
 - Game theoretic approaches to finding design tradeoff win-wins
- **Physics and engineering disciplines**
 - Understanding the actual phenomena we want to capture in multi-scale, multi-physics models
 - Validating multi-scale, multi-physics models



Novel Elements of Approach



- **Focus on re-design: retrofit/upgrade/adapt faster and cheaper**
- **Selectively explore feasible variations, reconfigurations, extensions**
- **Three lines of defense against change and uncertainty:**
 - Mission-oriented design for adaptability, with testing against broad range of missions and environments, prepares for the “known unknowns”
 - Diversity from *longer retention of multiple* designs avoids fragility of monoculture
 - Increases chances of having options that will address any “unknown unknowns”
 - Forcing the entire process to be open to alternatives, architects the engineering process to facilitate as rapid and agile a response as possible -- even in the worst case
 - Reduced engineering times enable tighter (therefore less uncertain) planning horizons
- **Focus on design and testing *in context, with stakeholders***
 - Model more of the operating environment
 - Explore and evaluate current and future scenarios, jointly with associated CONOPS
 - Design and evaluate for *mission capability* rather than disjoint technical parameters



The Path to Achieving, “Agile and cost effective design, development, testing, manufacturing, and fielding of trusted, assured, easily modified defense systems”

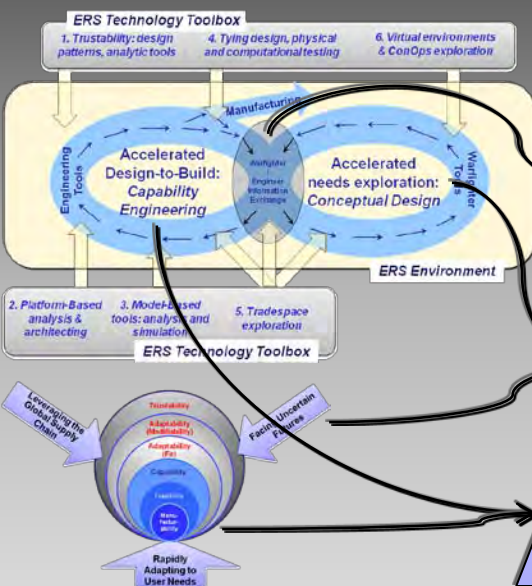


Timely & Affordable
via
selective search,
design-driven testing

Informed Decisions
via
larger tradespaces
(designs, constraints)

**Advanced Design
& Engineering
Capability**

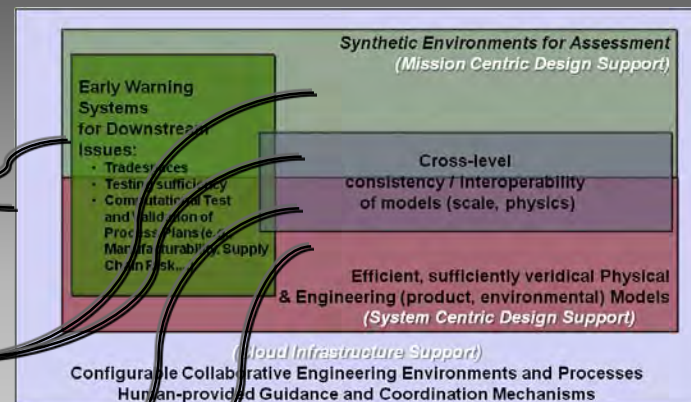
**Adaptable &
Trustworthy**
via longer-lived options,
contextual analysis
and testing



**Better coordination
between them**

Better conceptual design

Better deep design





Key ERS Goals, Concepts and Notional Roadmaps



Informed Decisionmaking

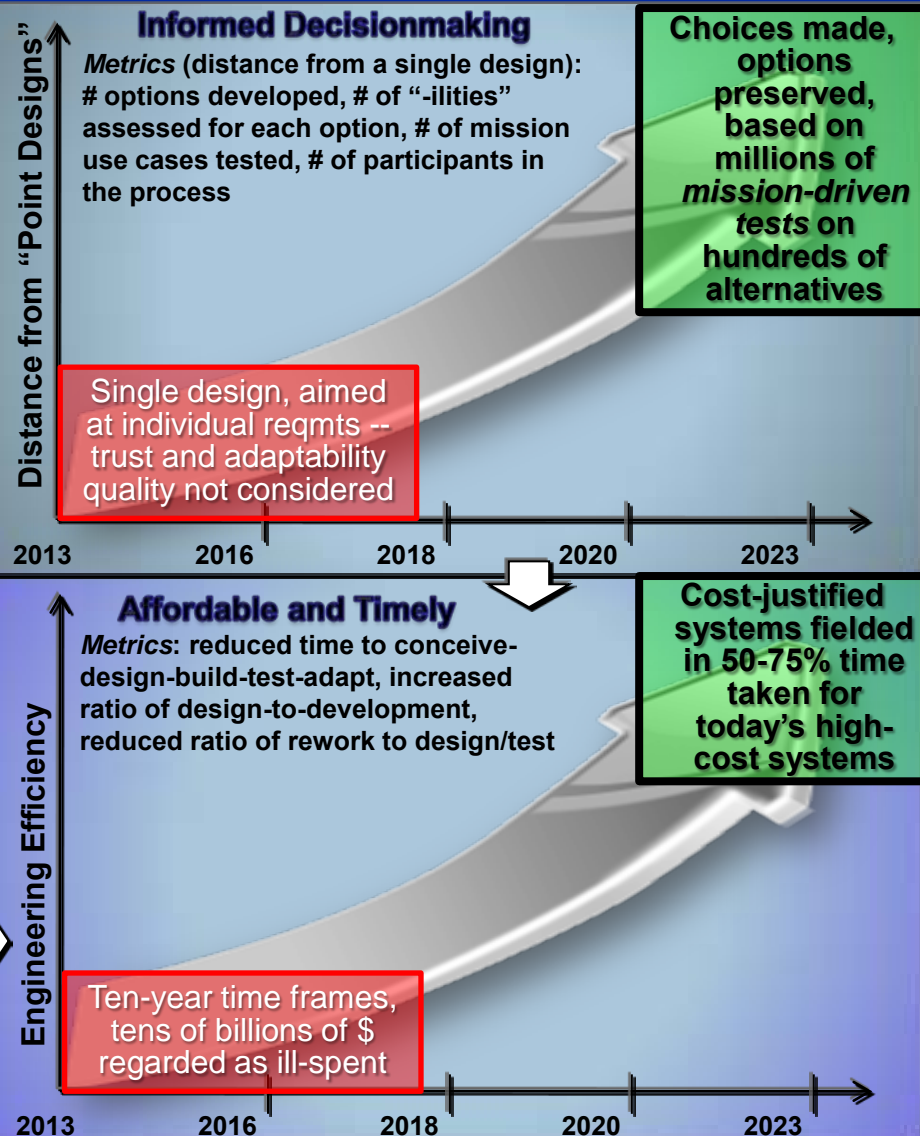
- Increasing the availability of engineering choices and the ability to assess consequences of those choices

Trustworthy and Adaptable Design

- Encouraging design for reliability, testing designs across many contexts (including degraded functioning), keeping options open, and learning from inspecting alternatives

Affordable and Timely

- As fast as possible for the problem addressed – minimizing unnecessary effort both reduces time and the cost of standing armies of engineers





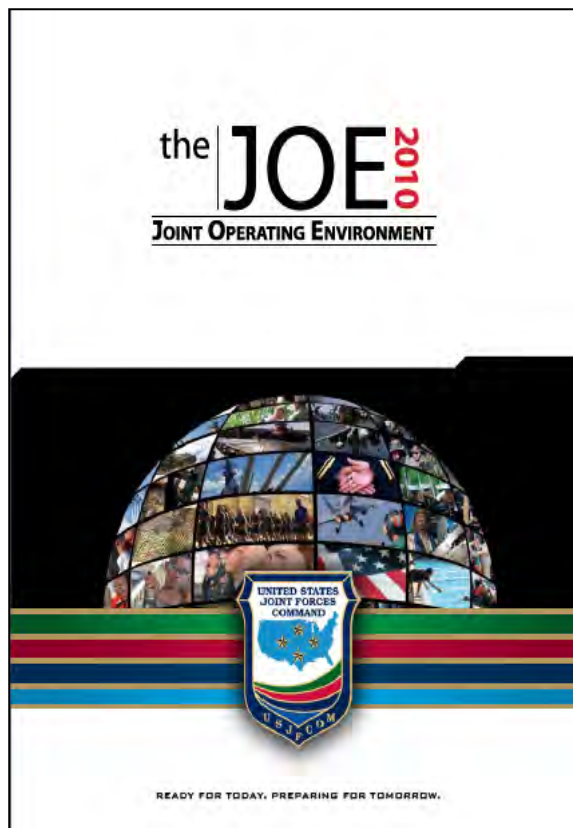
DoD Basic Research Program with a Focus on Academia

Dr. Randy K. Avent

21 June 2011



Key Challenges and Trends



- **Demographics**
 - Aging population in developed world
 - Growing youth population in developing world
- **Globalization**
 - World wide access to knowledge
- **Economics**
 - New wealth in Brazil, Russia, India & China
 - Large debts and deficits in developed nations
- **Energy**
 - High on every nation's priority list
- **Climate change & natural disasters**
- **Challenges to existing state structures**
 - Radical ideologies
 - Internet communities

A robust S&T program is necessary to address today's complex and changing defense environment



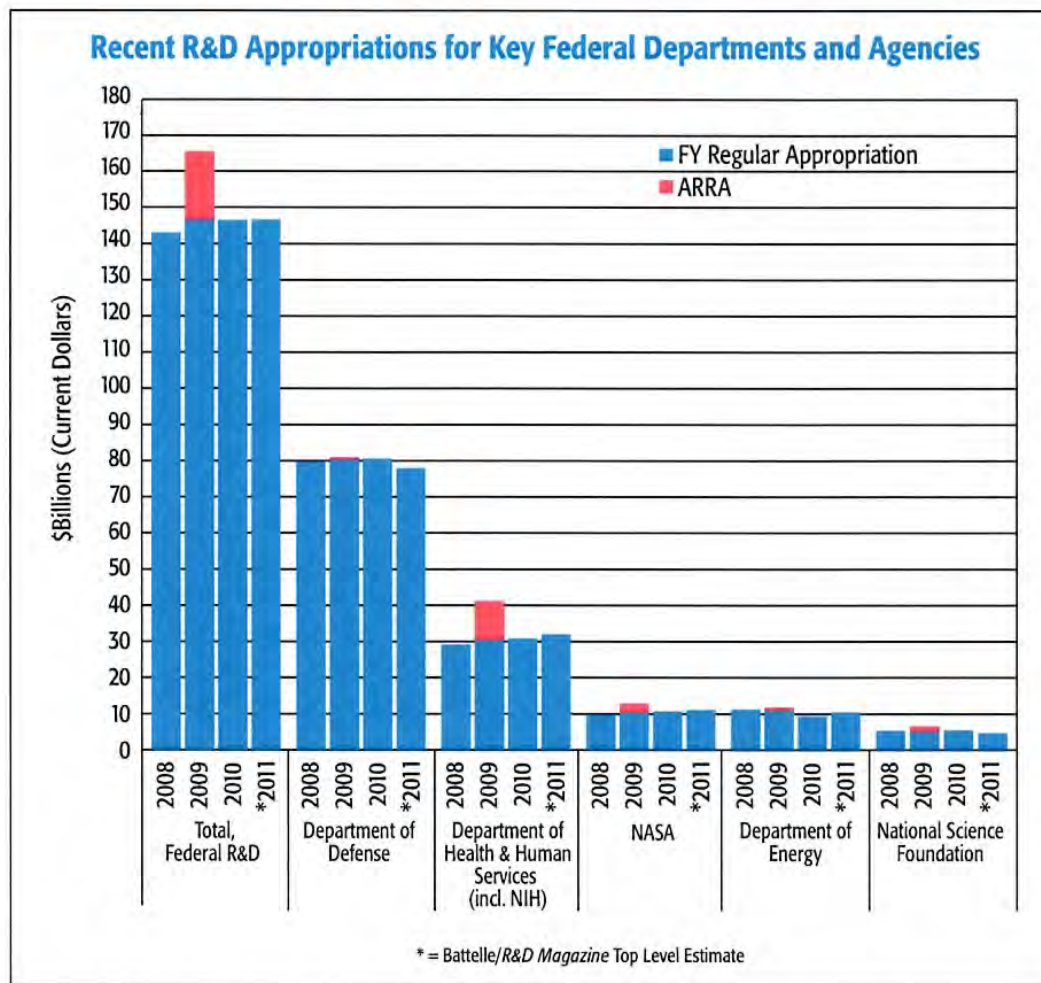
Outline



- Introduction
- **By the numbers**
- **Science initiatives**
- **Summary**



Federal Research Spending

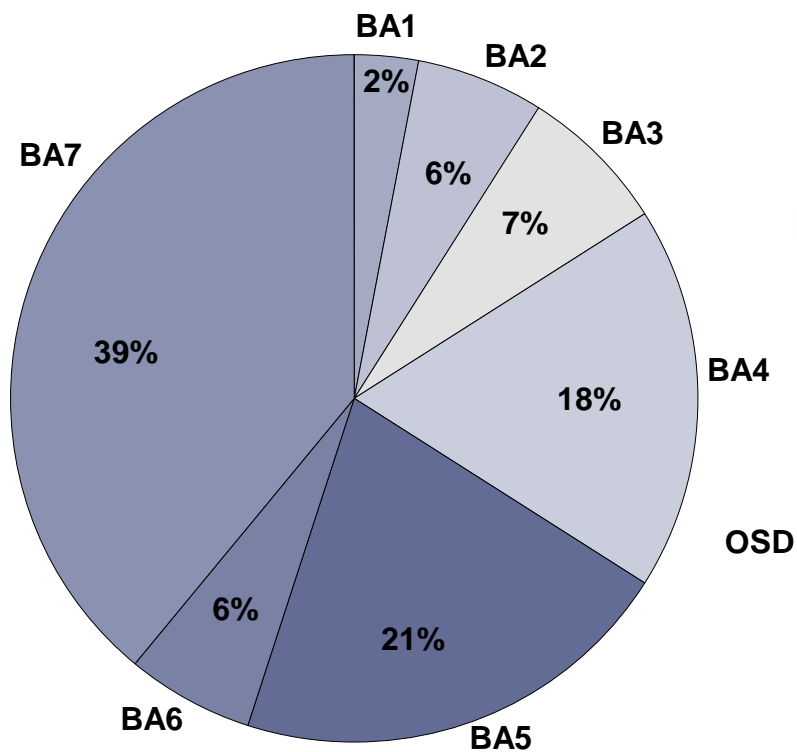


Source: Battelle/R&D Magazine with data from OSTP, AAAS

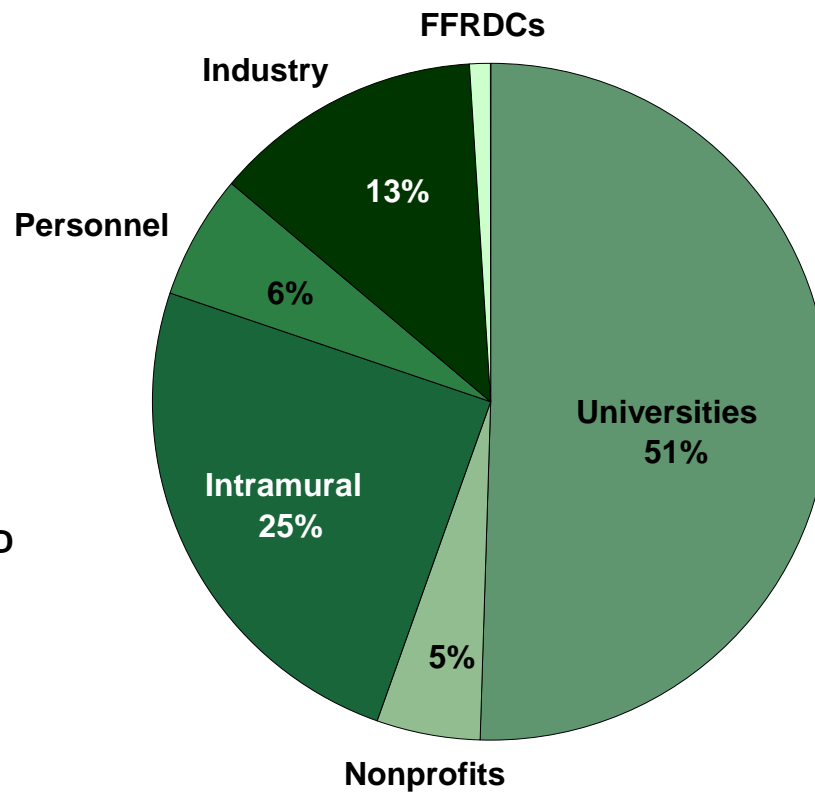


Basic Research Portfolios

- Defense Investments

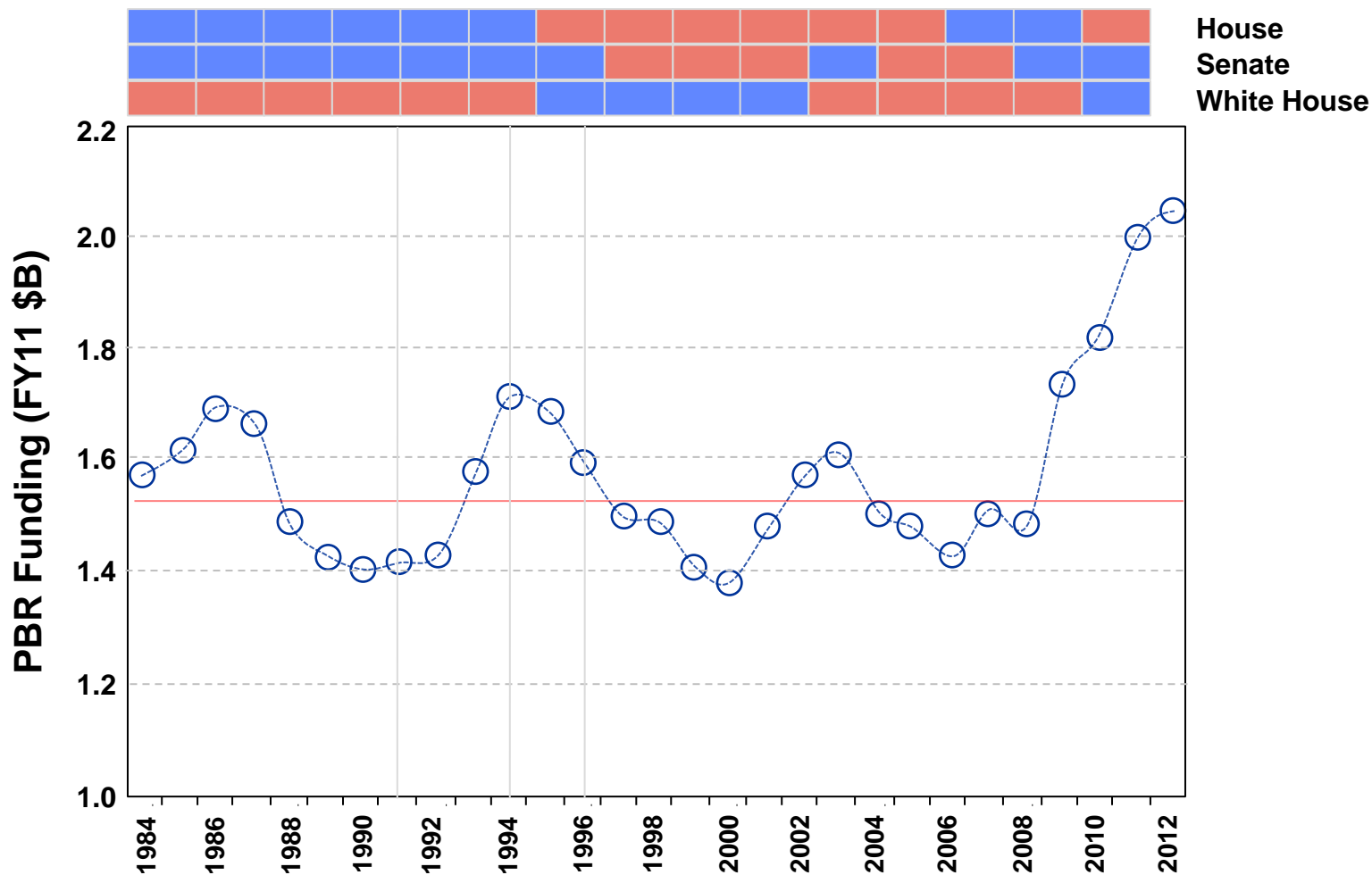


- Defense Recipients





Basic Research Funding





Outline

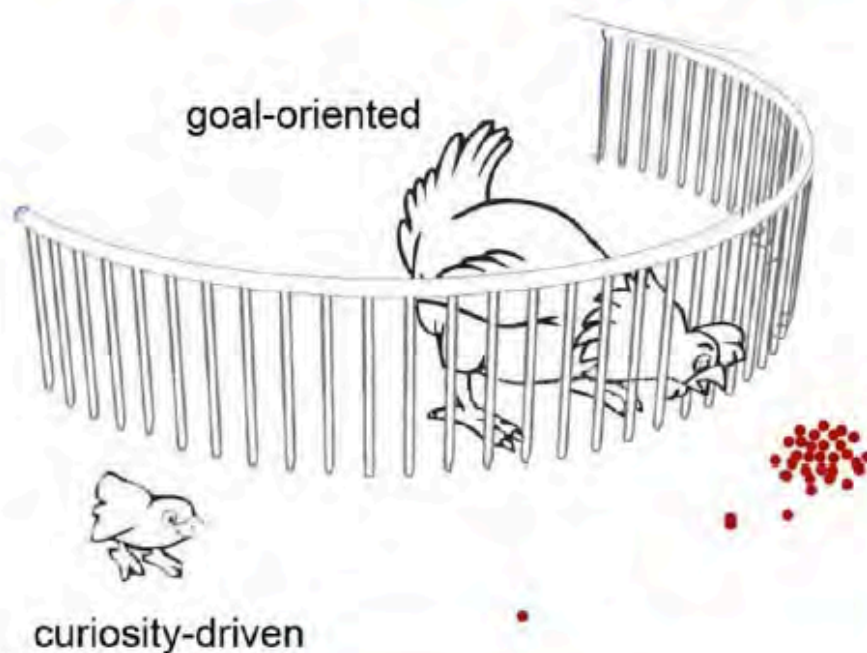


- Introduction
- By the numbers
- **Science initiatives**
- Summary



Basic Research Definitions

A lesson in research from Ted Hänsch...

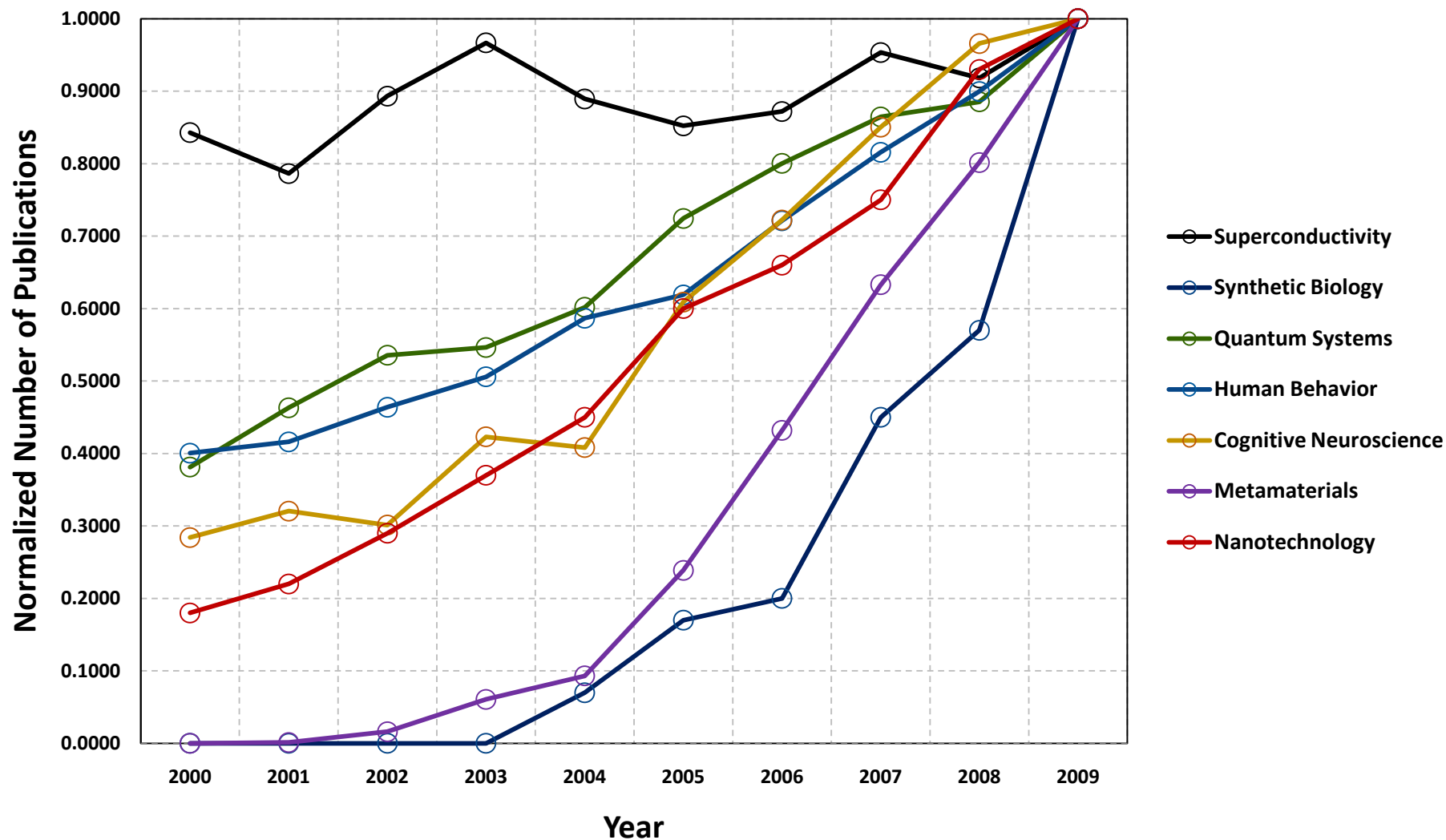


DDRE workshop on Future Directions in Physics, 1/21/2011

Basic Research should pursue fundamental understanding to provide a foundation for future work



Priority Basic Research Areas





Nanoscience and Nanotechnology



- **Discover and exploit unique phenomena at nanometer dimensions to enable novel applications**
- **Enabled capabilities**
 - Electronics and Sensing: Multispectral focal plane arrays
 - Power and Energy: Fuel-cells, portable electronics, thermoelectrics
 - Coatings: Photactive, self-cleaning films
- **Select breakthroughs**
 - Nano-particle coating & functionalization
 - Catalysts for energy-harvesting
 - Graphene and carbon nanotubes
- **Key research challenges**
 - Low defect density graphene over large areas
 - Production and reproducibility of chirality nanotubes and bilayers of graphene



Synthetic Biology/Panomics



- **The promise of engineered biology for a multitude of applications**
- **Enabled capabilities**
 - Bio-production including bio-fuels, food production
 - Bio-sensors
 - Tissue regeneration, broad-source vaccinations
 - Clean water as a bio-based capability
- **Key research challenges**
 - Modeling and simulation to address complexity of pathways
 - Automation of trials
 - Selection of appropriate host cell compatible with synthetic genome
 - Regulation and societal acceptance



Quantum Information Science



- **Manipulate and control nature down to the precision of a single quantum**
- **Enabled capabilities**
 - Quantum computing, Quantum communication
 - Quantum simulation
 - Quantum sensing, metrology and imaging
- **Select breakthroughs**
 - Quantum factorization algorithm
 - Quantum gas microscope
- **Key research challenges**
 - Maintaining quantum coherence over time
 - Discovering new algorithms that fully exploit QIS for additional new capabilities
 - New techniques to control quantum systems
 - New materials, fabrication for long coherence time



Metamaterials and Plasmonics

- **Engineered design of basic properties and transport of energy/information in materials and structures**
- **Enabled capabilities**
 - Nanoscale subsurface spectroscopy
 - Plasmon-enhanced detectors and imagers, Phased arrays
 - Novel coatings; Microvascular autonomic composites
- **Select breakthroughs**
 - Sub-wavelength elements, plasmonics, photonic crystals, metamaterials
 - Self-sensing and self-healing materials
 - Biologically-inspired structures
- **Key research challenges**
 - Efficiently convert optical radiation into localized energy
 - Enhanced local photophysical processes; 3-D photonic structures
 - Integrated plasmonics with nanostructured semiconductor devices



Cognitive Neuroscience

- **More deeply understand and more fully exploit the fundamental mechanisms of the brain**
- **Enabled capabilities**
 - Deeper understanding of human information processing, learning and decision making
 - Ameliorate/prevent PTSD and TBI
- **Select breakthroughs**
 - Advances in brain imaging, e.g., fMRI, Diffusion Tensor Imaging, digital EEG
 - Advances in correlation of brain-structure to function
 - Massively parallel computation enabling brain signal analysis
- **Key research challenges**
 - Solving the inverse problem of predicting human behavior from brain signals
 - Translating clinical measurements & analyses to uninjured personnel
 - Developing models incorporating individual brain variability



Computational Models of Human Behavior



- **A fundamental understanding and predictive capability of human behavior dynamics from individuals to societies**
- **Enabled capabilities**
 - Predictive models supporting strategic, operational and tactical decision making
 - Real-time cultural situational awareness; Immersive training
- **Select breakthroughs**
 - Early success of simple models
 - Success of social network analysis
 - Prediction of crowd tipping points
- **Key research challenges**
 - Conflicting theories
 - Data management and fusion
 - Mathematical complexity; validation of models



Summary



- **Future operations capabilities depend on the basic research achievements of today**
- **Five goals for DDR&E to strengthen the defense basic research program:**
 - **Provide scientific leadership** for the DoD basic research enterprise
 - **Attract the Nation's best S&Es** to contribute to and lead DoD research
 - **Ensure the coherence and balance** of the DoD basic research portfolio
 - **Foster connections** between DoD performers and the DoD community
 - **Maximize the discovery potential** of the defense research business environment
- **Achieving these goals results in a coherent, forward-thinking basic research program supported by the Nation's top researchers and paving the way for tomorrow's revolutionary breakthroughs**



Data-to-Decisions

Dr. Randy K. Avent

21 June 2011



Data-to-Decision Systems

Tactical Operations



- Low Latency
- Narrow Field-of-View
- Limited Fusion
- Automatic Target Recognition
- Data: ~MB-GB

Operations Intelligence



- Medium Latency
- Wide Field-of-View
- Hard Sensor Fusion
- Assisted Target Recognition
- Data: ~GB-TB

Strategic Intelligence



- Long Latency
- Synoptic Field-of-View
- Hard/Soft Sensor Fusion
- Multiple Hypotheses
- Data: ~PB-EB

The complexity and adaptability of threats has surpassed our ability to find them in large data volumes within mission timelines



D2D Technology Assessment



- Moderately Mature
- Driven by IT Industry

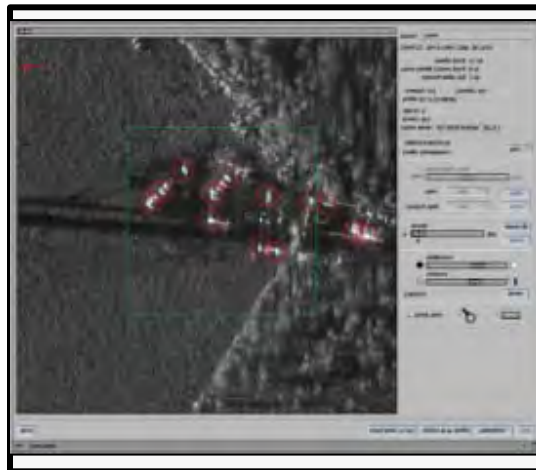
- Immature
- Driven by Defense

- Moderately Mature
- Driven by IT Industry

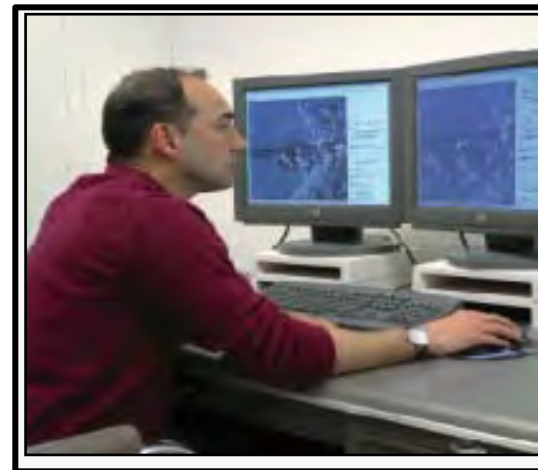
Data Management Layer



Analytics Layer



User Interface Layer



Current assessment is that unstructured data analytics is the most challenging and critical component of D2D



Outline



- Introduction
- **Technology Thrusts**
- **Summary**



Data Management Layer

- **Problem Statement: Increasing data volumes and modalities have diminished our ability to communicate, store, retrieve and process sources within mission critical timelines**
- **3-to-5 year timeframe objective**
 - Computational infrastructure to support capturing, processing, marking, retrieval, and management of millions of information objects per second
 - Network architecture with embedded information management on existing networks to support both real-time and discovery mission data requirements
- **7-to-10 year timeframe objective**
 - Anticipatory autonomous control of sensors and compute resources to simultaneously support hundreds of consumer requests for analysis products



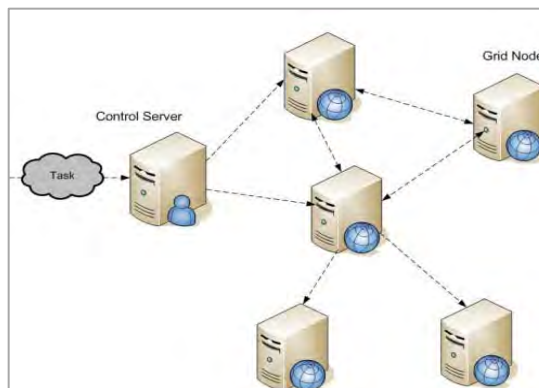
Hardware Infrastructure

• Embedded System



- On-board storage
- Tightly coupled data and algorithms
- Low-latency, low-bandwidth operations

• Grid Cluster



- Centralized storage
- Data moved to compute nodes
- Tightly coupled algorithms
- Parallel file system limits large data use

• Cloud Computing



- Distributed storage
- Applications moved to compute nodes
- Order-independence through map/reduce



Analytic Layer

- **Problem Statement: Existing automation tools do not aid users in finding today's complex and adaptable threats within mission timelines**
- **3-to-5 year timeframe objective**
 - Robust classification to accurately detect, geo-register and identify surface objects despite difficult environments, configurations and emplacements
 - Robust automation tools to identify relationships, patterns of life and activities of ground vehicles
 - Robust tools to capture, store and retrieve HUMINT-based information to identify and leverage popular support against insurgents
- **7-to-10 year timeframe objective**
 - Robust classification to accurately detect, geo-register and identify all surface objects despite difficult environments, configurations and emplacements
 - Robust automation tools to identify relationships, patterns of life and activities of dismounts
 - Robust tools to search, mine and exploit open-source data to identify all aspects of insurgent networks



```

graph TD
    DP[Data Preparation] --> TP[Track Prediction]
    TP --> AM[Association Matrix]
    AM --> TA[Track Assignment]
    TA --> TU[Track Update]
    TU --> HM[Hypothesis Management]
    HM --> UTL[Updated Track List]
    UTL --> TP
    UTL --> DP
  
```

Data Preparation

- Time sequencing
- Registration
- Bias correction

Track Prediction

Association Matrix

- Clustering
- Score pairings
- Assignment Matrices

Track Assignment

- Hypothesis generation
- Hypothesis evaluation
- Breadth reduction

Track Update

- Kalman update
- Multi-iteration

Hypothesis Management

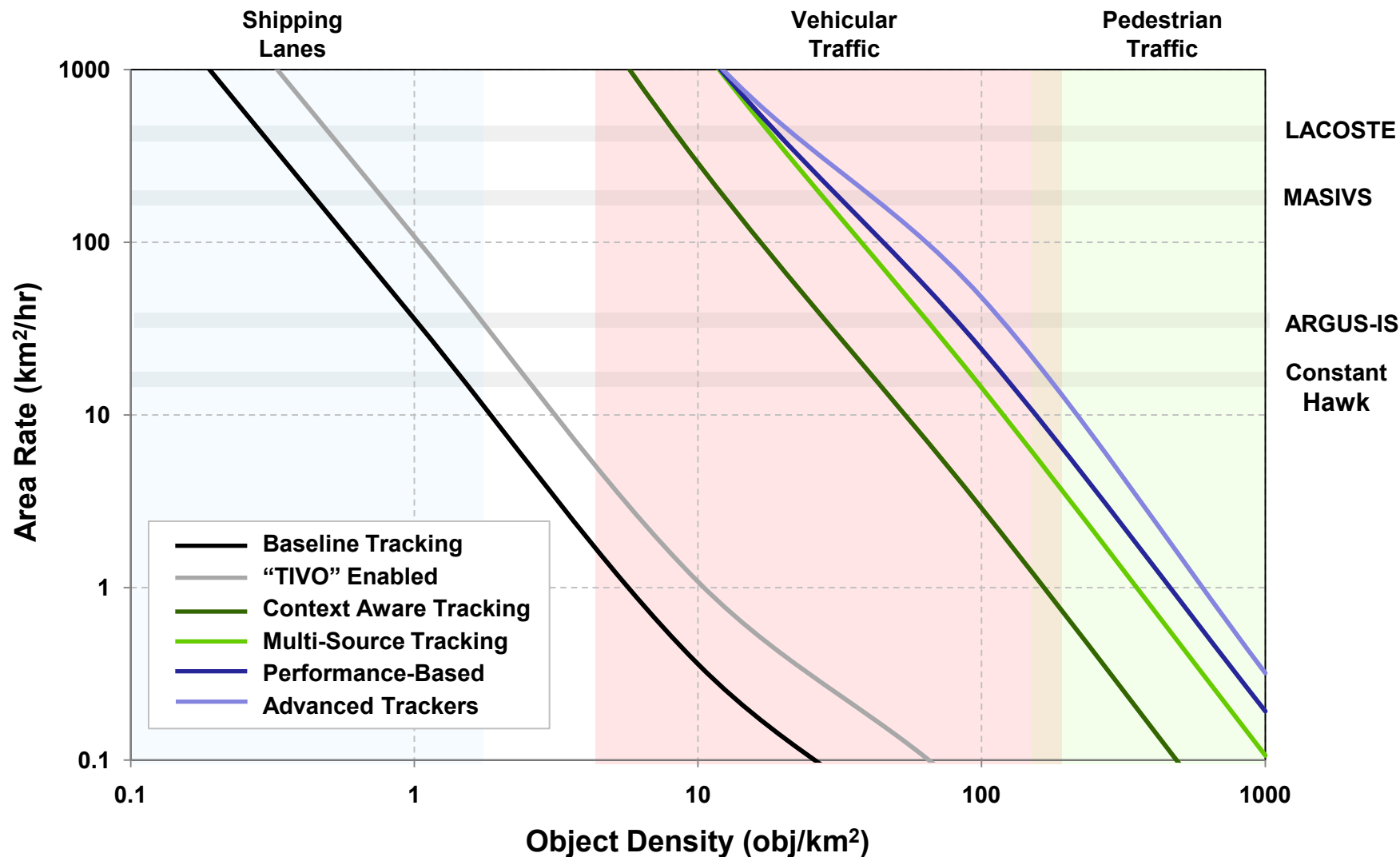
- Hypothesis pruning
- Track initiation
- Coasting

Updated Track List

- Updated tracks

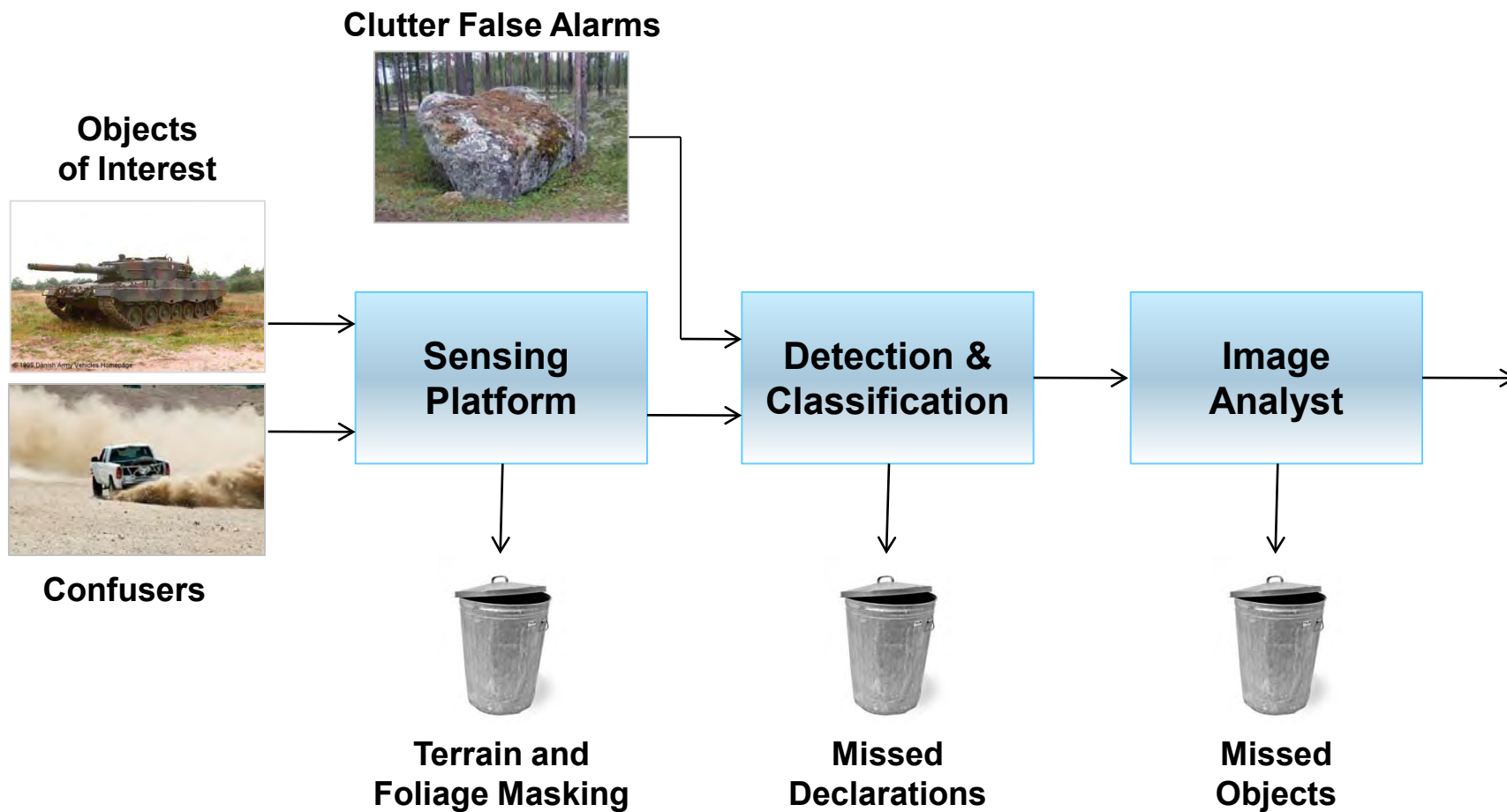


Tracking Analysis



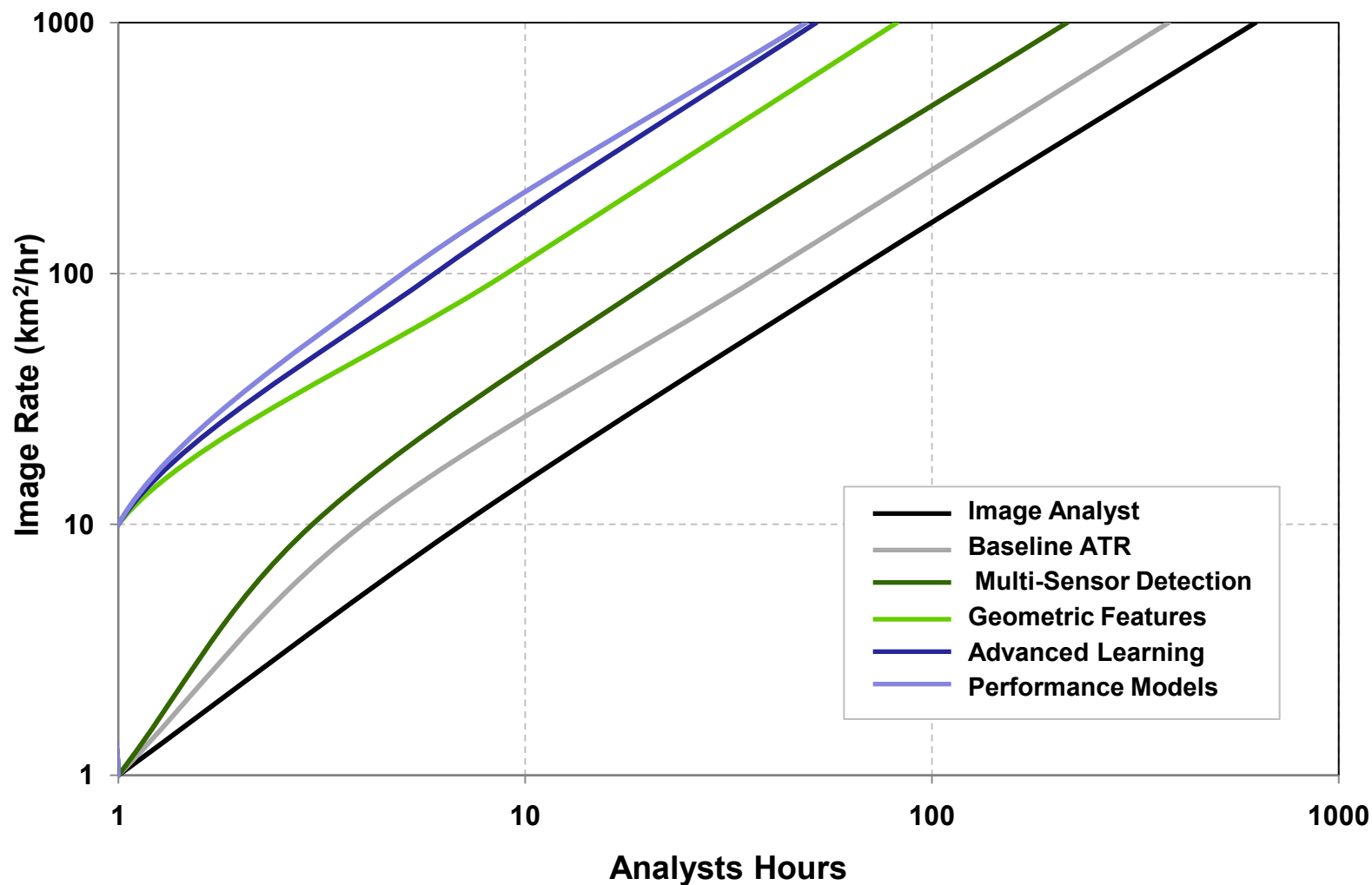


Imagery Processing Chain





Detection/Classification Analysis





Text Analysis

	Advanced Machine Translation	HSCB Analysis	Document Exploitation (DOCEX)*	A&V from Text (Link/Temporal/Spatial)
Text Preparation (OCR, Speech, MT, Zoning)	Yellow	Yellow	Yellow	Yellow
Entity/Event Resolution & Consolidation	Grey	Yellow	Yellow	Red
Advanced Entity/Relation/Event Extraction	Grey	Red	Yellow	Red
Time/Location Stamping	Grey	Yellow	Red	Red
Subjectivity/Sentiment Extraction	Grey	Red	Yellow	Yellow
Text Mining	Grey	Yellow	Red	Red
Portability (Genre/Domain/Language)	Red	Red	Red	Red
Multilingual Extraction	Red	Red	Red	Yellow

* This refers to *operational* Document Exploitation (DOCEX); when Special Ops Forces (SOF) finds hard copy documents at a site and we need to process for intel info

Acronyms & Abbreviations

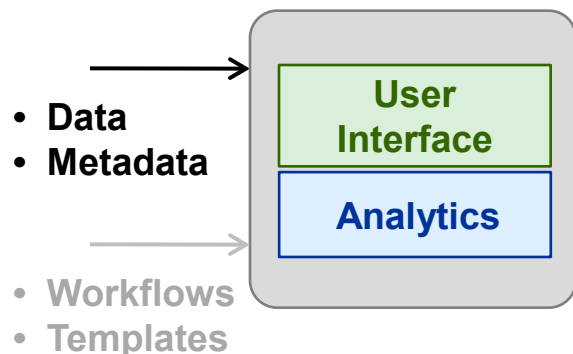
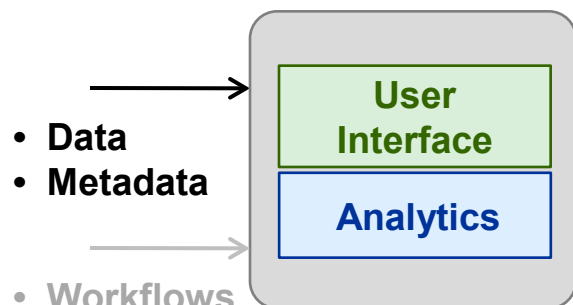
A&V = Analysis & Visualization
HSCB = Human Social Cultural Behavioral
MT = Machine Translation
OCR = Optical Character Recognition

Grey N/A Green TRL 6-9 Yellow TRL 3-6 Red TRL 1-3



User Interface Layer

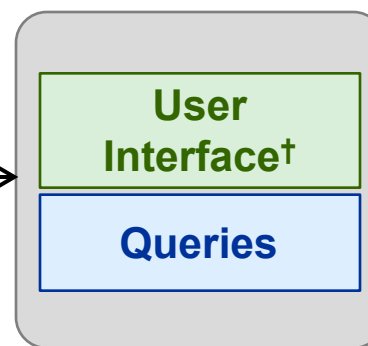
• Analysts (Single Source)



• Aggregators (All-Source)

- Data
- Metadata+
- Tags
- Provenance
- Ontologies

- Data
- Metadata+
- Tags
- Provenance
- Ontologies



- Reports
- Usage Statistics
- Ontologies
- Workflows
- Provenance

- Ontologies
- Workflows
- Tags
- Templates

†End User Programmable



User Interaction Layer



- **Problem Statement: Existing interface tools do not support the user's need to collaborate, visualize, adapt and manage knowledge gained from sensing assets**
- **3-to-5 year timeframe objective**
 - User tools that aid data discovery, link communities, support aggregation and provide natural user interfaces
- **7-to-10 year timeframe objective**
 - Never-ending learning systems that maintain and reason over millions of facts to identify new knowledge
 - Workflow tools that capture and teach analysts' best practices



Summary



- **The Data-to-Decisions program develops technology for the rapid development of flexible new Decision Support Systems**
- **Program consists of a series of relevant challenge problems that advance the underlying technology in data management, analytics and user interfaces**
- **Execution is through a consortium that addresses the challenge problems in a coherent and integrated team approach**
- **Major research initiatives focus on developing extendable analytic approaches and advanced user-interface modules**



**Fiscal Year 2012
President's Budget Request
for the
DoD Science & Technology Program
June 21, 2011**

***Mr. Bob Baker
Deputy Director, Plans & Programs,
Assistant Secretary of Defense (Research & Engineering)***



Outline



- ***Guidance from the Chain of Command***
- ***FY2012 S&T President's Budget Request***
- ***Historical Context***
- ***Strategic Planning & Budget Changes***



Connecting Researchers to the Warfighter



President Obama, State of the Union, January 25, 2011



*"The first step in winning the future is encouraging American innovation. Our free enterprise system is what drives innovation. But because it's not always profitable for companies to invest in **basic research**, throughout our history, our government has provided cutting-edge **scientists** and inventors with the support they need.*

*Two years ago, I said that we needed to reach a level of **research and development**, we haven't seen since the Space Race. And in a few weeks I'll be sending a budget to Congress that helps us meet that goal. We'll **invest in biomedical research, information technology, and especially clean energy technology** -- an investment that will strengthen our security, protect our planet, and create countless new jobs for our people.*

*Maintaining our **leadership in research and technology** is crucial to America's success. But if we want to win the future - - if we want innovation to produce jobs in America and not overseas -- then we also have to win the race to educate our kids.*

*Over the next 10 years, with so many baby boomers retiring from our classrooms, we want to prepare 100,000 new teachers in the **fields of science and technology and engineering and math.**"*

Investment in Basic and Applied Research is a commitment to the future warfighter



Thoughts from the Secretary of Defense



**Secretary Gates, Budget Rollout
Hearing 14 Feb 2011**

“These budget decisions took place in the context of a nearly two year effort by the DoD to reform the way the Pentagon does business – to change how and what we buy...We have protected programs that support military people, readiness, and modernization...We still live in a very dangerous and often unstable world. Our military must remain strong and agile enough to face a diverse range of threats – from non-state actors attempting to acquire and use weapons of mass destruction and sophisticated missiles, to the more traditional threats of other states...”

“Directed DoD to fund 2% real growth in Basic Research and to maintain stable funding in the rest of S&T for FY12-FY16. In real terms, the FY12 S&T budget request is almost 29% greater than the request in FY 2000.” OSD/PA News Release, 2/14/11



Continuing the Reform Agenda

“Budget represents a reasonable, responsible, and sustainable level of funding” - Secretary Gates, Budget Rollout Brief (2/14/2011)

- Taking Care of People
- Rebalancing Military Capabilities
- Reforming What and How We Buy
- Supporting our Troops in the Field



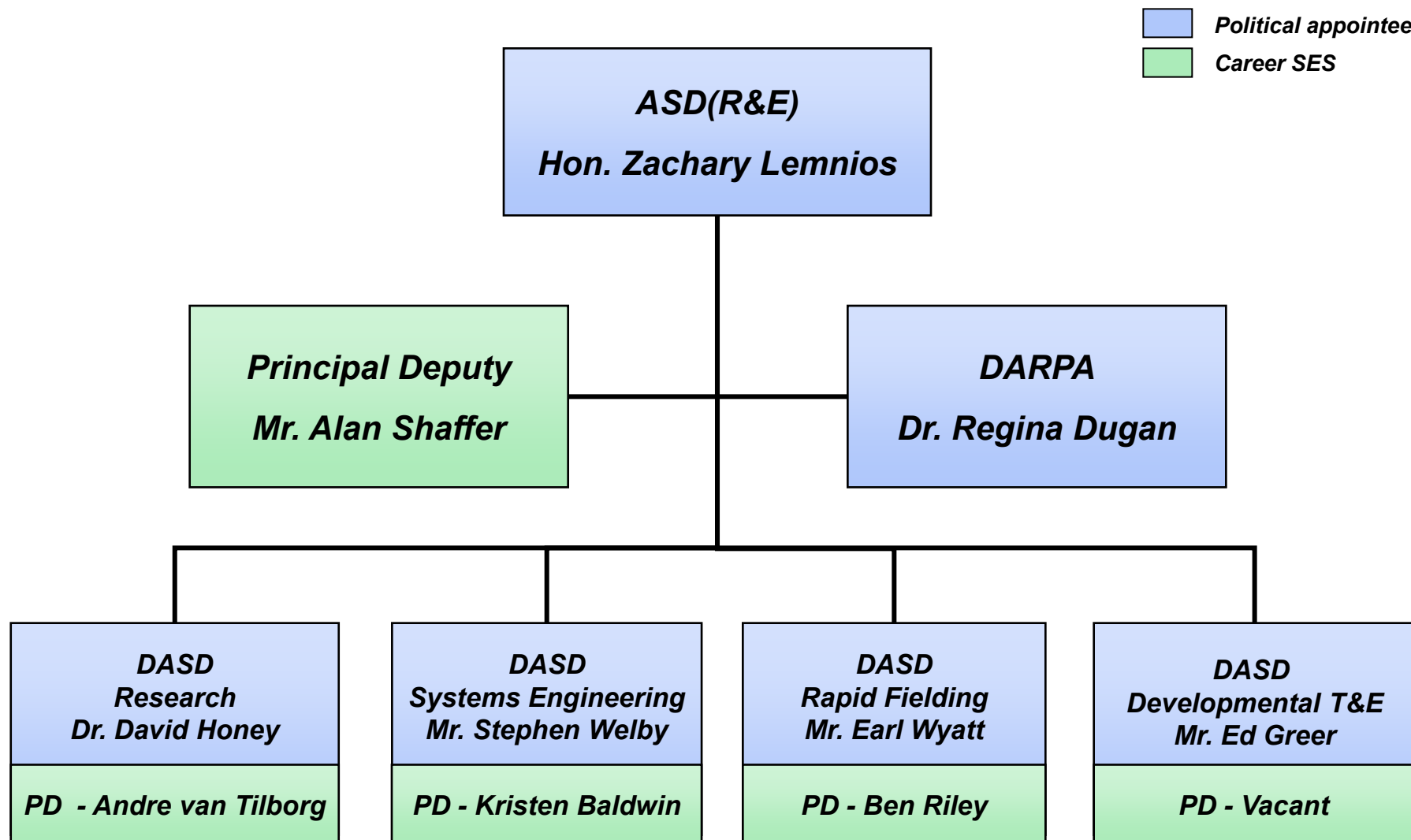


ASD(R&E) Imperatives

- **Accelerate delivery of technical capabilities to win the current fight.**
 - Solve the most difficult near term problems and transition compelling concepts to the warfighter.
- **Prepare for an uncertain future.**
 - Shape the Department's science and technology investments to open options that counter (and create) strategic surprise.
- **Reduce the cost, acquisition time and risk of our major defense acquisition programs.**
 - Provide systems engineering leadership, deep system analysis, and technical assessments across the Department.
- **Develop world class science, technology, engineering, and mathematics capabilities for the DoD and the Nation.**



ASD(R&E) – Organization





Outline



- ***Guidance from the Chain of Command***
- • ***FY2012 S&T President's Budget Request***
- ***Historical Context***
- ***Strategic Planning & Budget Changes***

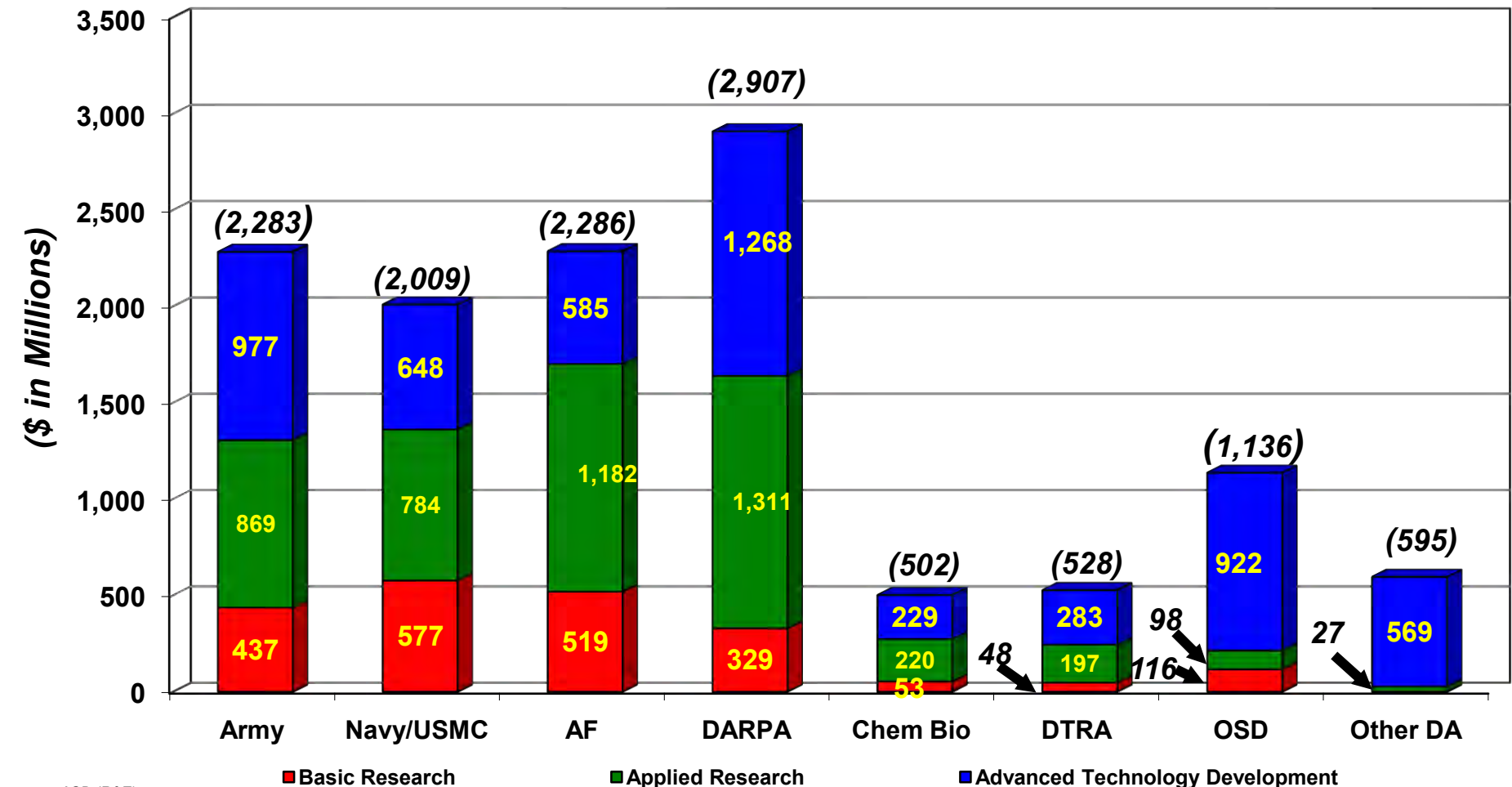


FY12 DoD S&T Budget Request

Total FY12 S&T request = \$12.25B

Total FY11 S&T Request = \$11.82B

Army = 1,945 Navy = 1,961 AF = 2,191 DARPA = 3,026 ChemBio = 396 DTRA = 555 OSD = 1,356 Other DA = 389





FY12 President's Budget Request



BP12	BA	FY11	FY12	FY13	FY14	FY15	FY16
		PBR 11	PB12 CIS	PB12 CIS	PB12 CIS	PB12 CIS	PB12 CIS
DoD	BA 1	1,998,797	2,078,470	2,137,917	2,221,206	2,305,688	2,404,212
DoD	BA 2	4,475,822	4,687,273	4,680,455	4,712,527	4,758,137	4,854,129
DoD	BA 3	5,344,430	5,481,225	5,765,877	5,874,758	6,028,726	6,126,183
	DoD S&T	11,819,049	12,246,968	12,584,249	12,808,491	13,092,551	13,384,524
Army	BA 1	406,873	436,920	440,492	456,268	470,582	487,449
	BA 2	841,364	869,332	860,648	856,203	840,534	832,660
	BA 3	696,592	976,812	949,153	983,936	966,542	983,685
	Army S&T	1,944,829	2,283,064	2,250,293	2,296,407	2,277,658	2,303,794
Navy	BA 1	556,425	577,372	599,398	622,310	646,079	670,756
	BA 2	678,680	783,794	782,973	772,408	809,831	821,744
	BA 3	725,599	648,217	606,260	641,203	629,779	641,636
	Navy S&T	1,960,704	2,009,383	1,988,631	2,035,921	2,085,689	2,134,136
AIR FORCE	BA 1	500,473	518,859	538,233	558,331	579,179	600,805
	BA 2	1,181,420	1,181,874	1,187,232	1,203,560	1,227,057	1,250,541
	BA 3	509,305	585,404	562,607	579,470	590,288	600,329
	Air Force S&T	2,191,198	2,286,137	2,288,072	2,341,361	2,396,524	2,451,675
Def-Agencies	BA 1	535,026	545,319	559,794	584,297	609,848	645,202
	BA 2	1,774,358	1,852,273	1,849,602	1,880,356	1,880,715	1,949,184
	BA 3	3,412,934	3,270,792	3,647,857	3,670,149	3,842,117	3,900,533
	Def-Agencies S&T	5,722,318	5,668,384	6,057,253	6,134,802	6,332,680	6,494,919

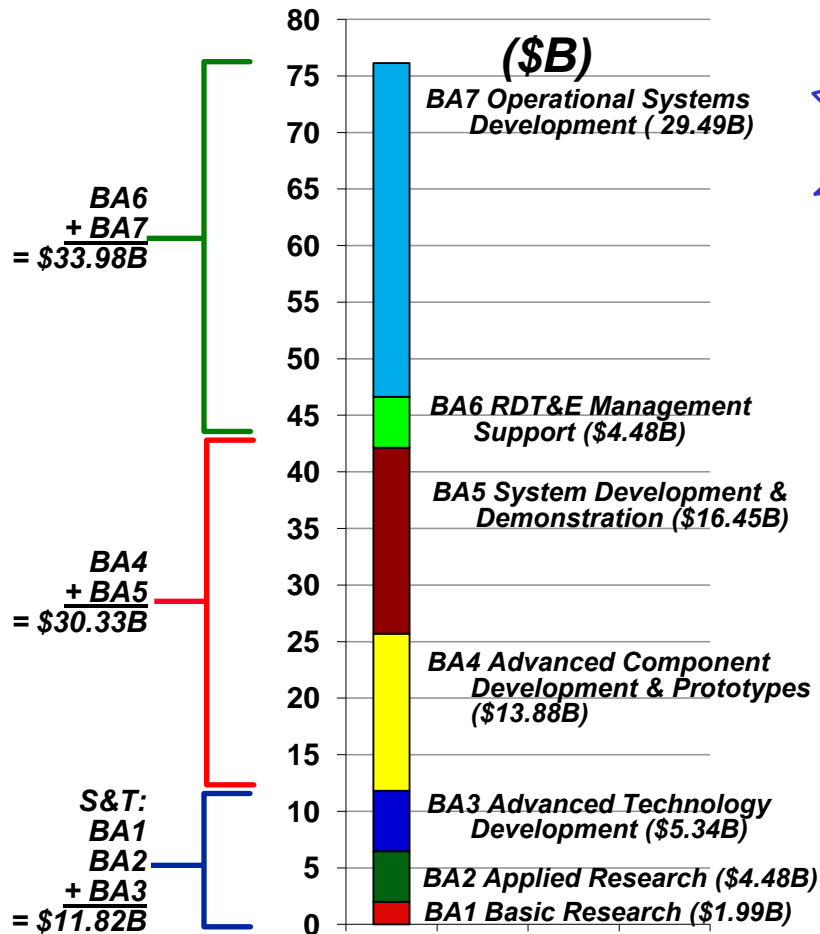


FY11 and FY12 RDT&E Budget Request Comparison

- in Then Year Dollars -



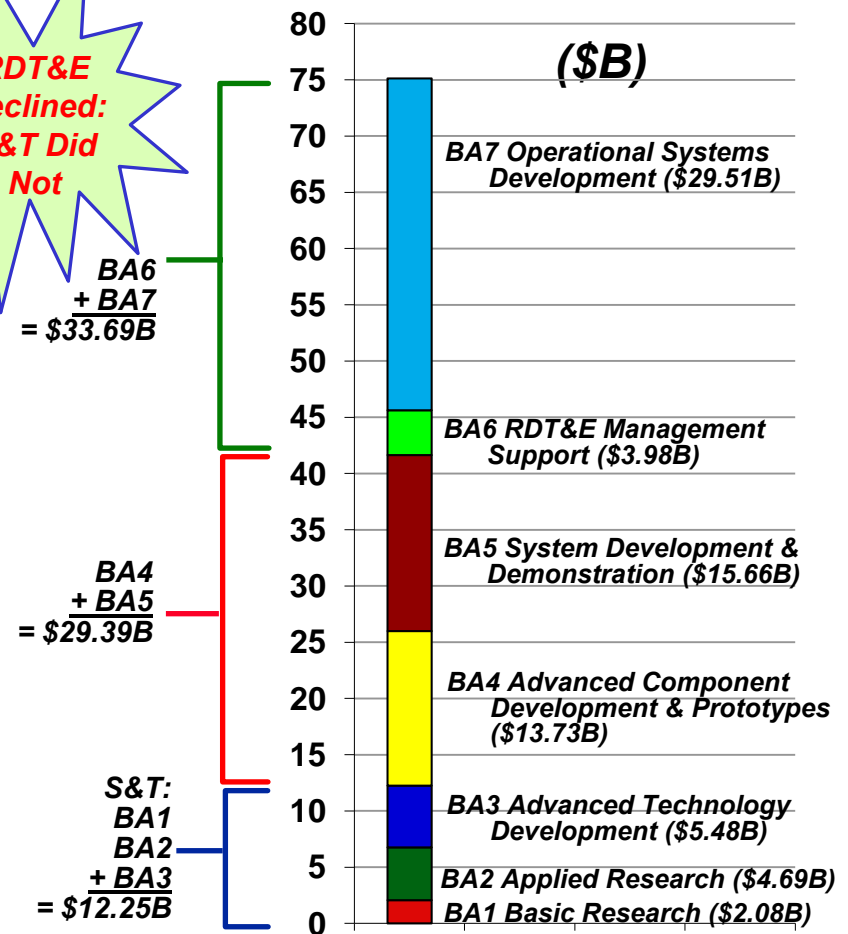
FY11 RDT&E request = \$76.13B
(Budget Activities 1-7)



Technology Base (BA1 + BA2) = \$6.47B

PBR11 S&T is 15.5% of RDT&E

FY12 RDT&E request = \$75.33B
(Budget Activities 1-7)



Technology Base (BA1 + BA2) = \$6.77B

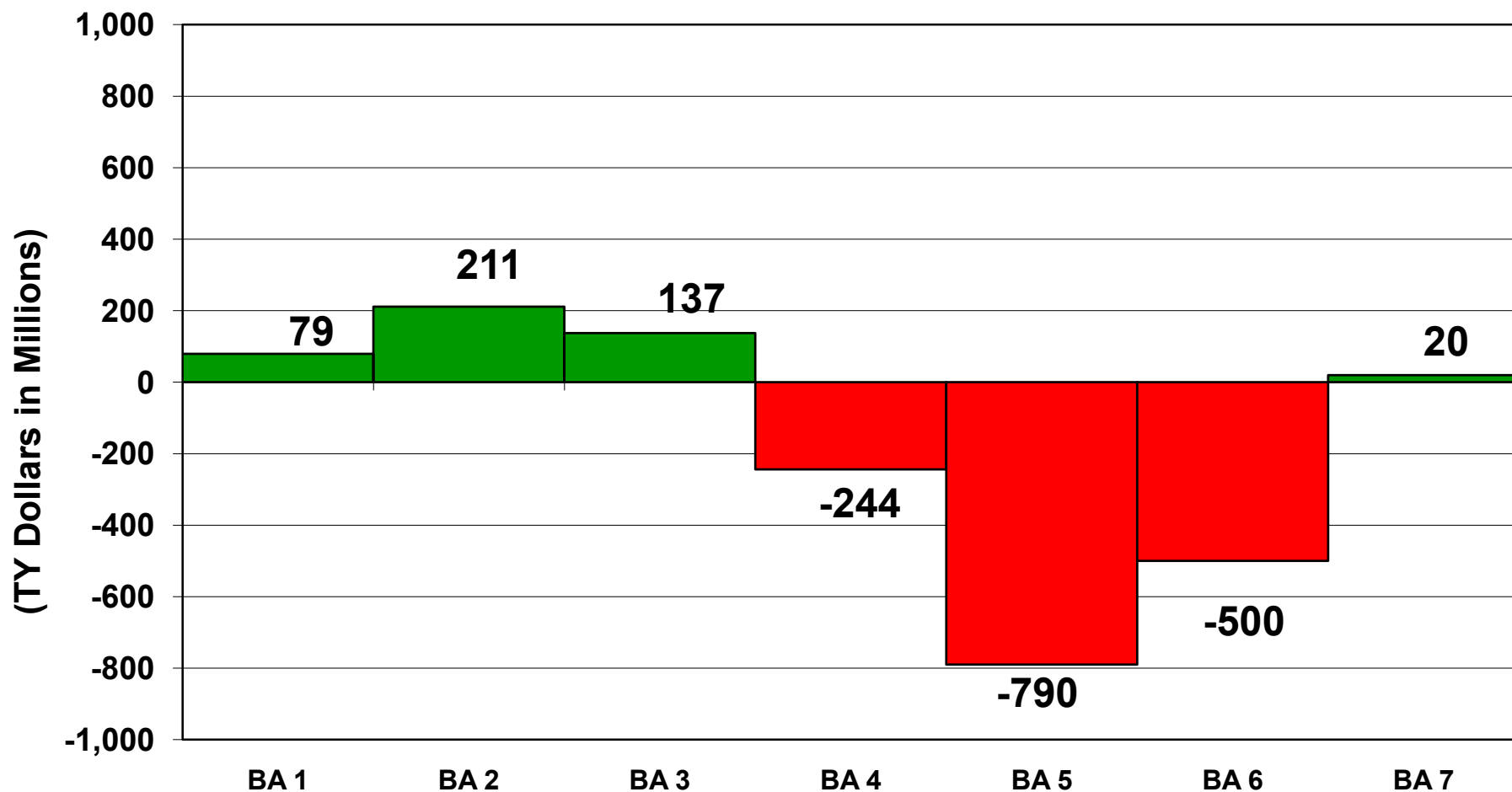
PBR12 S&T is 16.2% of RDT&E

**RDT&E Declined:
S&T Did Not**



RDT&E Budget Request Overview

- FY11 and FY12 Comparison -





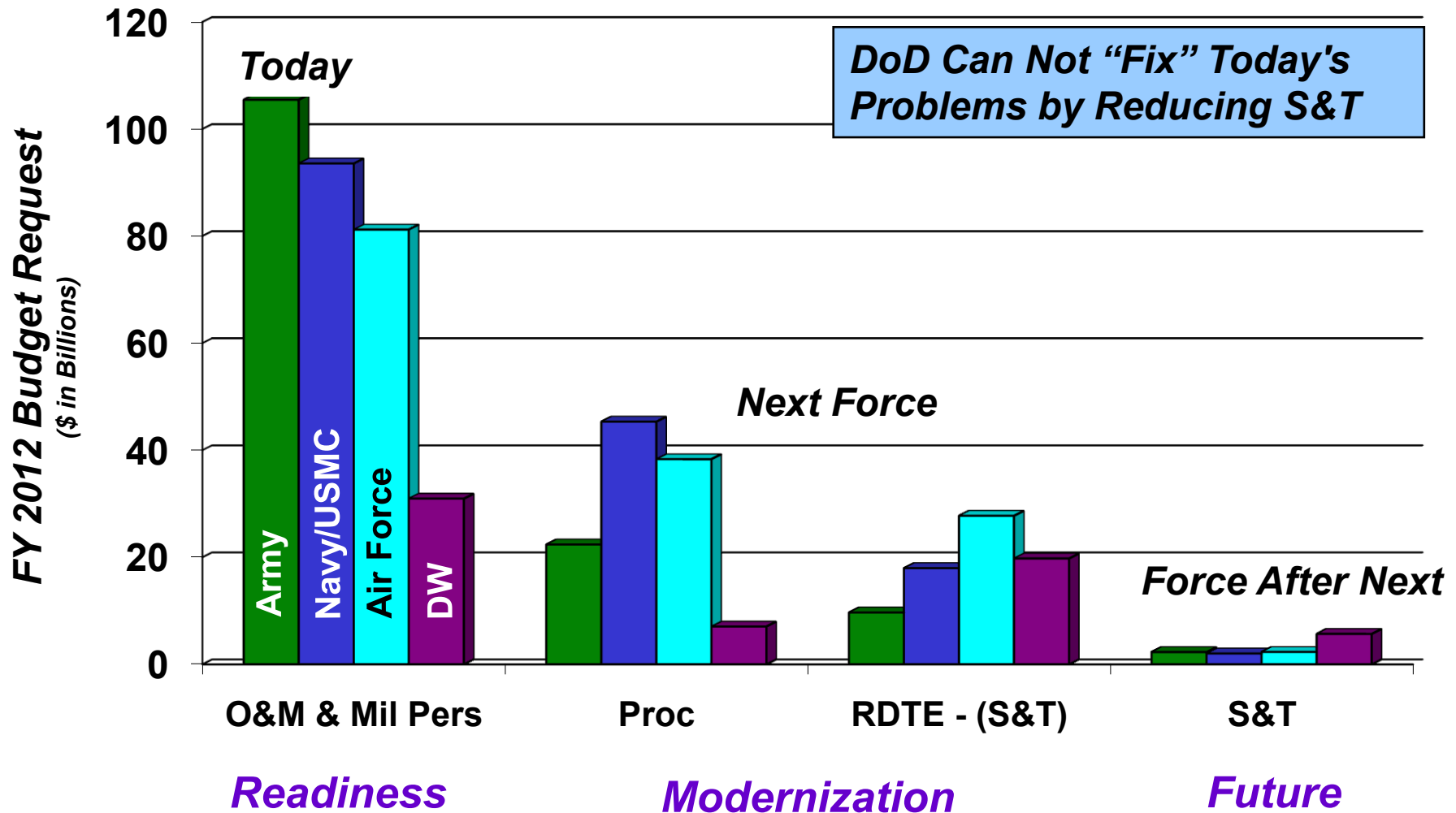
FY12 DoD R&E Budget Request Comparison



	PBR 2010	PBR 2011 (CY FY11 \$)	PBR 2012 (CY FY11 \$)	Real Change from PBR11 to PBR12 (CY FY11 \$)
Basic Research (BA 1)	1,798	1,999	2,078 (2,043)	+2.2%
Applied Research (BA 2)	4,247	4,476	4,687 (4,608)	+2.9%
Advanced Technology Development (BA 3)	5,605	5,344	5,481 (5,388)	0.8%
DoD S&T	11,649	11,819	12,247 (12,039)	1.9%
Advanced Component Development and Prototypes (BA 4)	14,306	13,877	13,733 (13,401)	-3.4%
DoD R&E (BAs 1 – 4)	25,956	25,696	25,880 (25,440)	-1.0%
DoD Topline	533,813	549,093	566,341 (556,710)	+1.4%



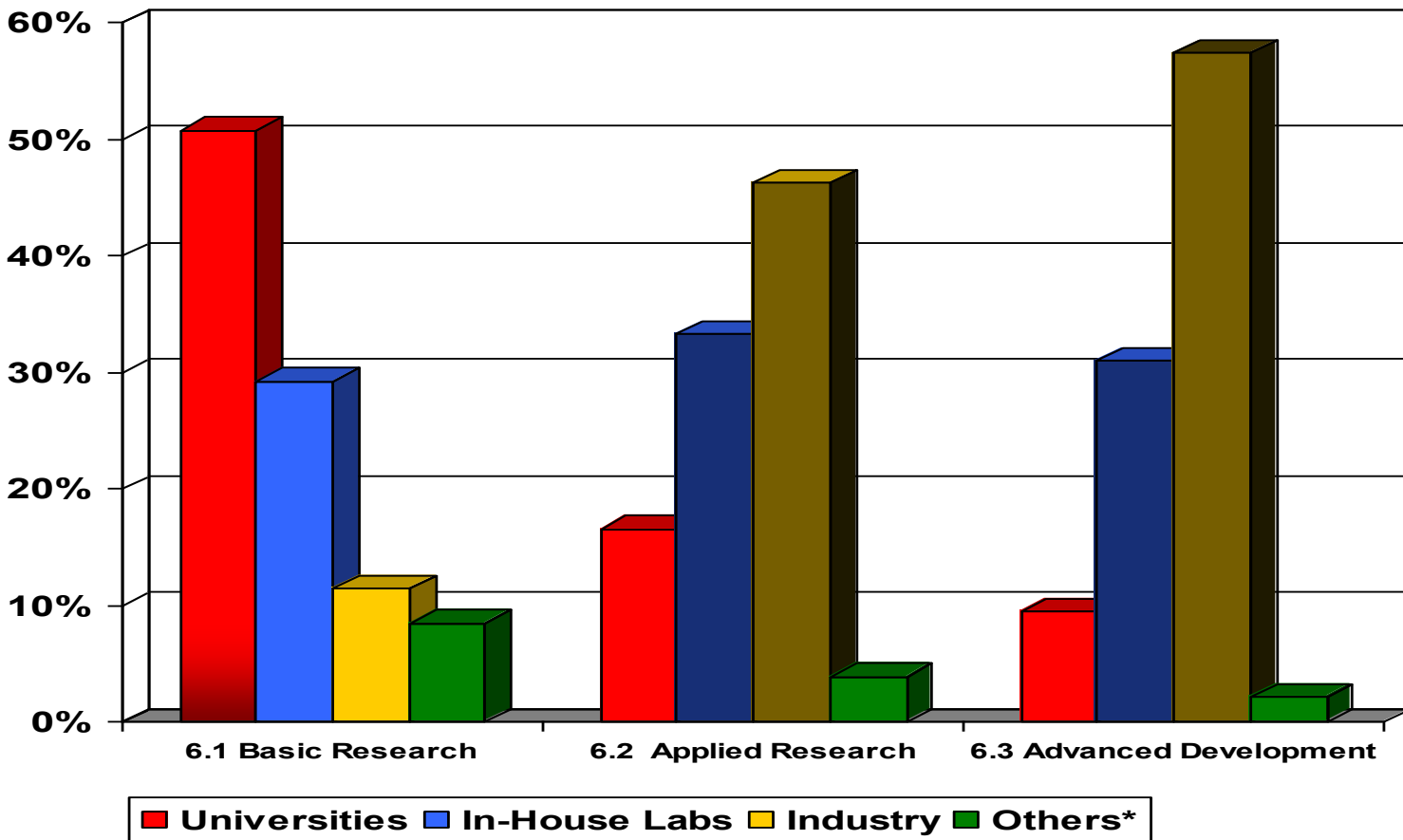
FY12 Technology Investment Compared to Other DoD Categories





Recipients of DoD S&T Funds

DoD S&T Funding Recipients by Percentage
(PBR08)



*Includes non-profit institutions, State & local govt., & foreign institutions

Source: National Science Foundation Report (PBR08)



Outline

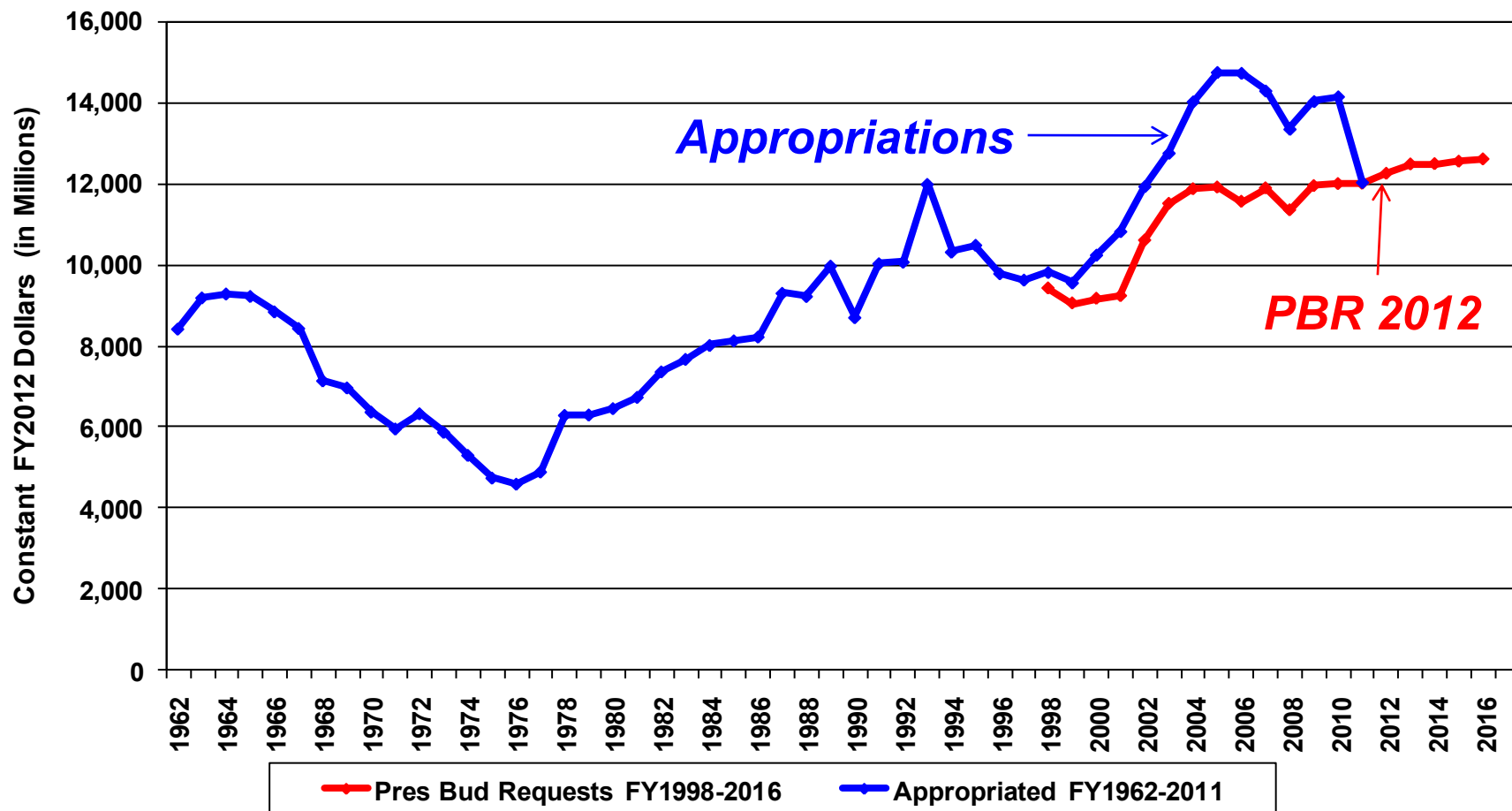


- ***Guidance from the Chain of Command***
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- • ***Historical Context***
- ***Strategic Planning & Budget Changes***



DoD S&T FUNDING: FY1962-2016

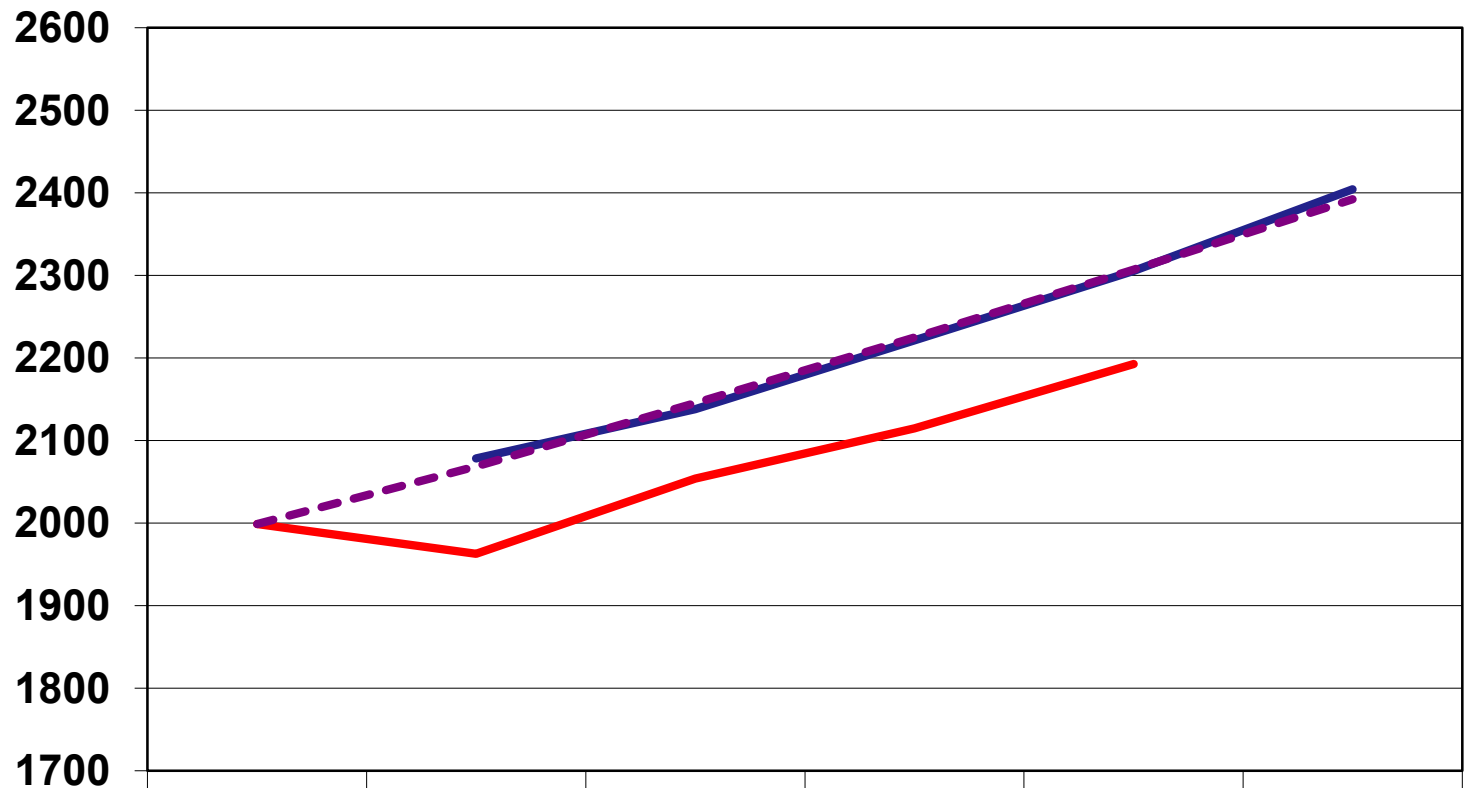
(Constant FY12 Dollars)





DoD Basic Research

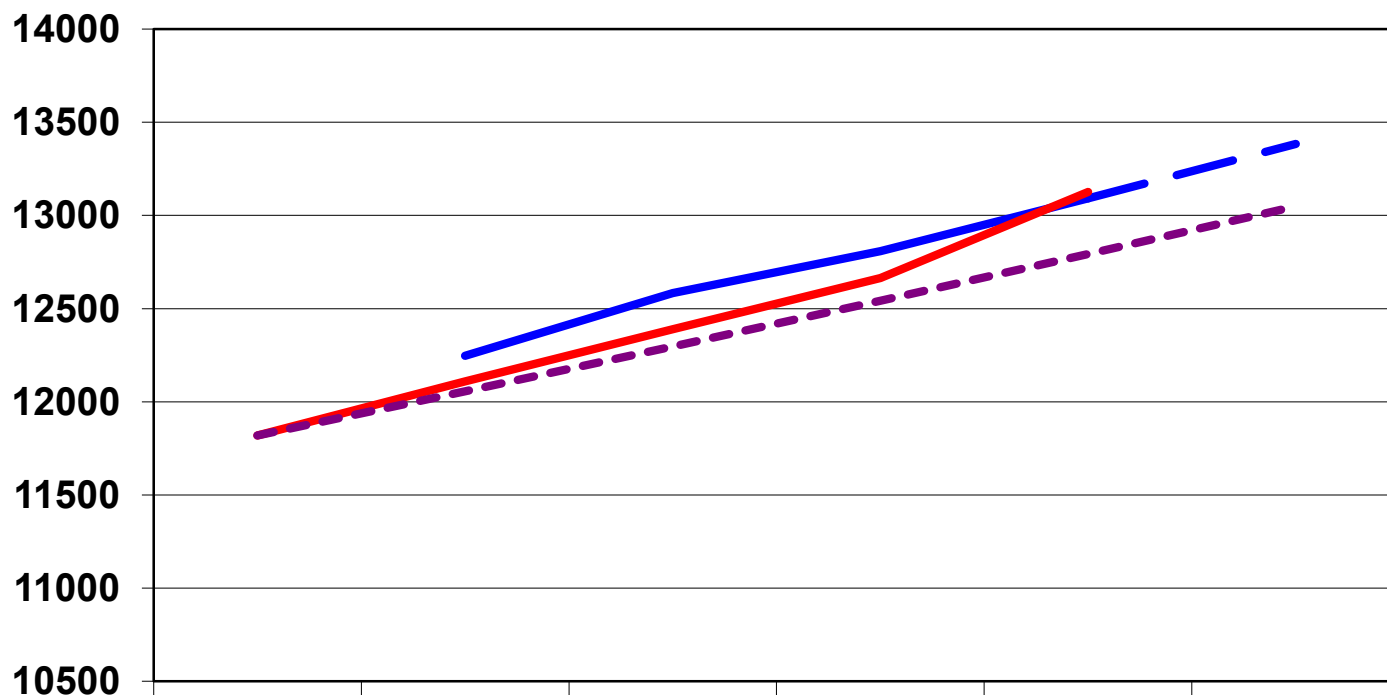
(TY Dollars in Millions)



	FY2011	FY2012	FY2013	FY2014	FY2015	FY2016
PBR-12		2,078	2,138	2,221	2,306	2,404
PBR-11	1,999	1,963	2,054	2,115	2,193	
2% RPG	1,999	2,069	2,145	2,225	2,307	2,392
Δ - PBR11 versus PBR12		116	84	106	113	



DoD Science & Technology (TY Dollars in Millions)

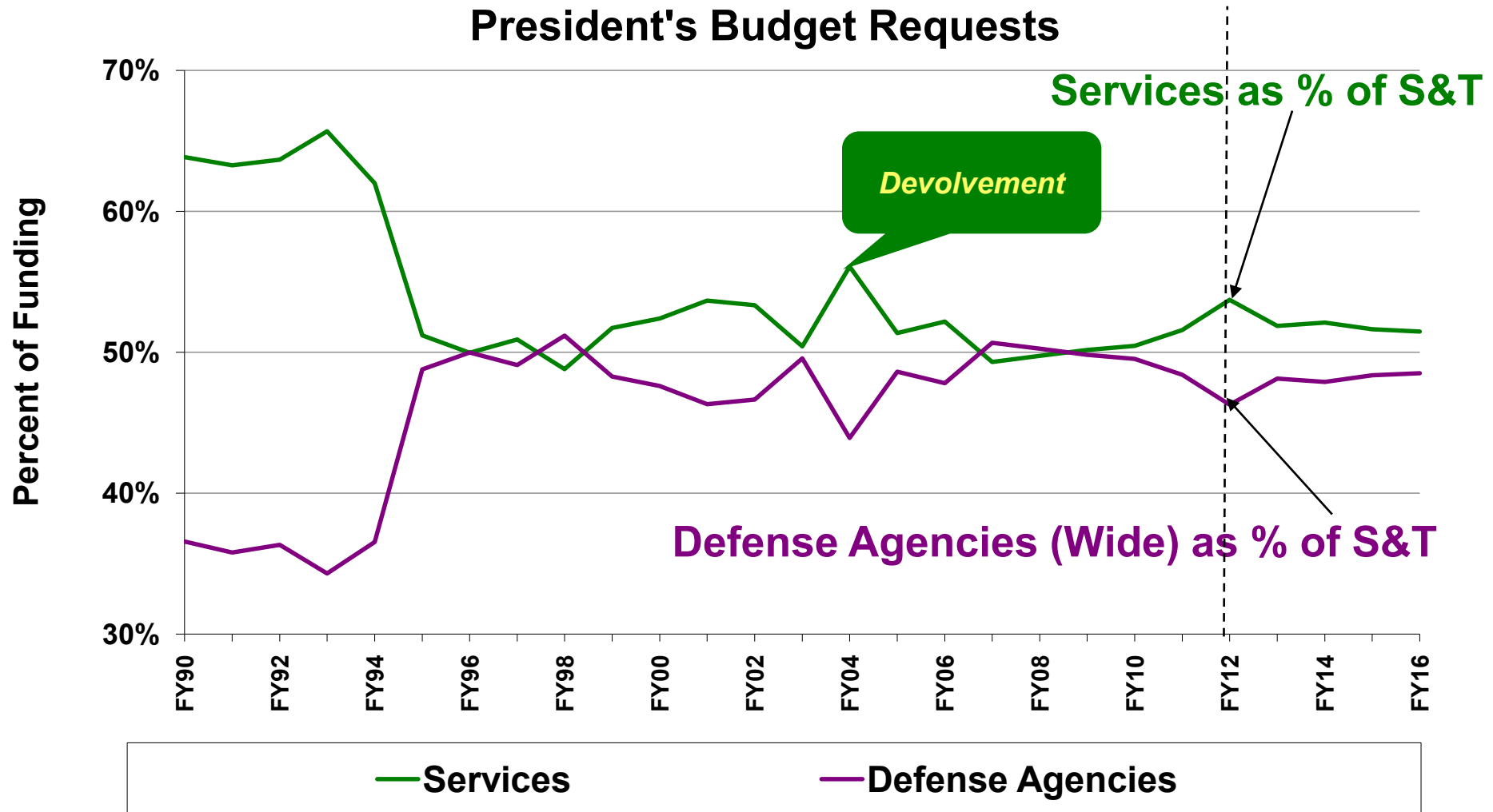


	FY2011	FY2012	FY2013	FY2014	FY2015	FY2016
— PBR-12		12,247	12,584	12,808	13,093	13,385
— PBR-11	11,819	12,109	12,390	12,663	13,125	
- - - 0% RPG	11,819	12,055	12,297	12,542	12,793	13,049
Δ - PBR12 versus PBR11		138	194	145	-33	



S&T Breakout

- Services and Defense Agencies (Wide) as % of Total S&T -





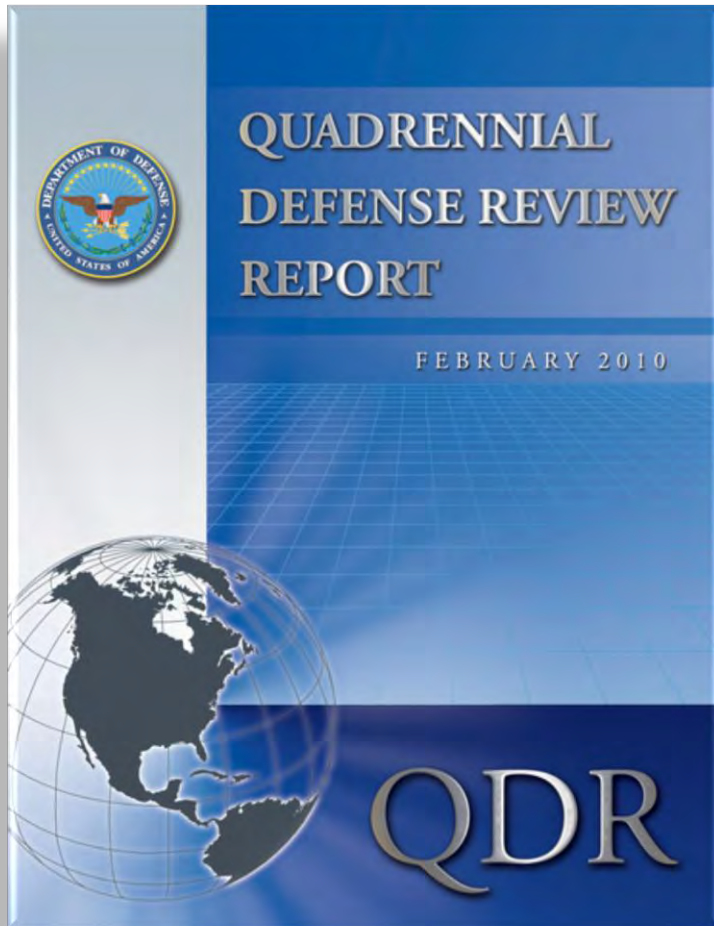
Outline



- ***Guidance from the Chain of Command***
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Quadrennial Defense Review Key Mission Areas (KMAs)



- 1. Defend the United States and Support Civil Authorities at Home***
- 2. Succeed in Counterinsurgency, Stability, and Counterterrorist Operations***
- 3. Build the Security Capacity of Partner States***
- 4. Deter and Defeat Aggression in Anti-Access Environments***
- 5. Prevent Proliferation and Counter Weapons of Mass Destruction***
- 6. Operate Effectively in Cyberspace.***



QDR 2006 vs. QDR 2010

QDR 2006 Strategic Outcomes

1. ***Defend the Homeland in Depth***
2. ***Defeat Terrorist Networks***
3. ***Shape the Choices of Countries at Strategic Crossroads***
4. ***Prevent the Acquisition or use of Weapons of Mass Destruction***



QDR 2010 Key Mission Areas

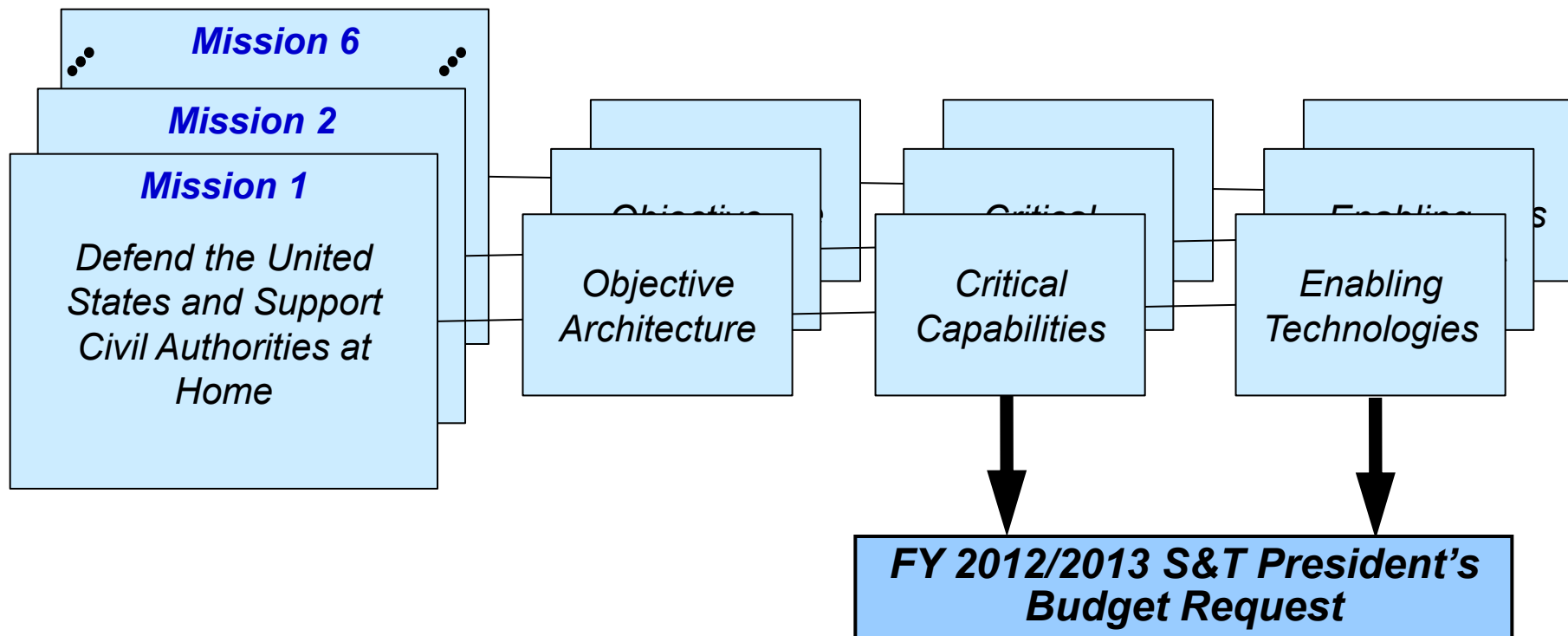
1. ***Defend the United States and Support Civil Authorities at Home***
2. ***Succeed in Counterinsurgency, Stability, and Counterterrorism Operations***
3. ***Build the Security Capacity of Partner States***
4. ***Deter and Defeat Aggression in Anti-Access Environments***
5. ***Prevent Proliferation and Counter Weapons of Mass Destruction***
6. ***Operate Effectively in Cyberspace***



**QDR 2010 Builds on QDR 2006
- Anti-Access and Cyberspace are New -**



QDR Key Mission Area Studies Approach





Priority S&T Investment Areas for FY 2013-2017



- **Data-to-Decisions**
 - Science and applications to reduce the cycle time and manpower requirements for analyses and use of large data sets.
- **Engineered Resilient Systems**
 - Engineering concepts, science, and design tools to protect against malicious compromise of weapon systems, and to develop agile manufacturing for trusted and assured defense systems.
- **Cyber Science and Technology**
 - Science and technology for efficient, effective cyber capabilities across the spectrum of joint operations.
- **Electronic warfare / Electronic protection**
 - New concepts and technology to protect systems and extend capabilities across the electro-magnetic spectrum.
- **Counter Weapons of Mass Destruction (WMD)**
 - Advances in DoD's ability to locate, secure, monitor, tag, track, interdict, eliminate, and attribute WMD weapons and materials.
- **Autonomy**
 - Science and technology to achieve autonomous systems that reliably and safely accomplish complex tasks in all environments.
- **Human Systems**
 - Science and technology to enhance human-machine interfaces to increase productivity and effectiveness across a broad range of missions.



Big Moves DoD Wide

FY2012

Program	Funding (Increase from FY11PBR-FY12PBR)	Agency
<i>Taking Care of People</i>		
1 Defense Health	~ \$ 125 M	DHP; Services
<i>Force Protection</i>		
2 Chemical Bio-Defense Program	~ \$ 100 M	NCB
3 Cyber S&T	~ \$ 76 M	DARPA
4 Force Protection	~ \$ 49 M	Navy & Army
5 RF Systems	~ \$ 45 M	Navy
<i>Prepare for Uncertain Future</i>		
6 Info & Communications Technology	~ \$ 120 M	DARPA; AF
7 Weapons Technology	~ \$ 62 M	Services
8 Undersea Warfare	~ \$ 30 M	Navy
TOTALS	~ \$ 607 M	



Big S&T Moves, Last Three Budgets

FY2010 (~\$1.8B across the FYDP)

Medical S&T (Wounded Warrior) (~\$2.5B total; ~\$1B in S&T, remainder DHP)

Large Data Handling (ISR Cap) ~ \$100M)

Cyber Protection (~ \$100 M)

Anti-Tamper (~\$33M)

High Temperature Materials (~\$70M)

Stand-off Detection of Fissile Materials (~\$300)

High Performance Computing (~\$100M)

Minerva (Sociology Research) (~\$100M)

FY2011 (~\$1.6B across the FYDP)

7% increase in FY11 Basic (6.1) and Applied Research (6.2) from FY10 base (~\$544M)

Deployable Force Protection (~\$238M)

Cyber Security Research (~\$200M)

Night Vision Technology-Advanced Focal Plane Array (\$94M)

High Energy Laser Advanced Technology (\$512M)

FY2012 (~\$0.6B; \$3.0 B across the FYDP)

Protection of Defense Health (\$125 M)

Information and Communication Technology (\$120 M)

Force Protection Technology (\$49 M)

Chemical and Biological Defense Technology (\$100 M)

Cyber Security (\$76 M)

Advanced Undersea Warfare Applied Research (\$30 M)

Key

Joint Programs
Multiple Executors

Army
Navy
Air Force



Summary



- ✦ **Overall S&T up 1.9% (in real terms) from FY11 PBR**
 - ✦ **Grew at a faster rate than DoD top line (1.4%)**
 - ✦ **All three categories (6.1, 6.2. 6.3) had real growth**
 - ✦ **RDT&E is down, but S&T is up**
- ✦ **Met SECDEF Guidance**
- ✦ **Big Moves Included:**
 - ✦ **Protection of Defense Health Program**
 - ✦ **Information and Communications Technology**
 - ✦ **Cyber S&T**
 - ✦ **Force Protection**
 - ✦ **Chemical and Biological Research**
 - ✦ **Weapons Technology**



How Capabilities are Developed and Delivered to the Combatant Commanders June 23, 2011

Mr. Bob Baker
Deputy Director, Plans & Programs
Assistant Secretary of Defense (Research & Engineering)



Service vs. COCOM Responsibilities

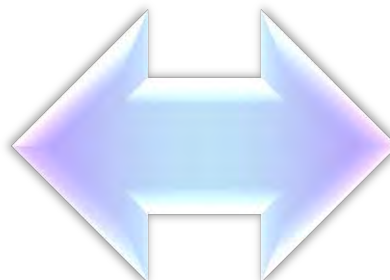


Military Services / Departments

Organize, Train & Equip



+



Combatant Commanders

Operationally Employ





How Capabilities are Developed and Delivered to the Combatant Commanders



Adaptive Response to Urgent Needs

- Rapid Acquisition / Procurement / Rapid Fielding

Transition to Procurement & Sustainment

- Joint Training / Global Force Allocation

Readiness & Suitability Confirmation

- Test & Evaluation
- Military assessment of utility

Functional Validation; Tailored Form/Fit/Function

- Demonstration

Technical Concept Design & Development

- Prototyping

Alternatives Development & Assessment

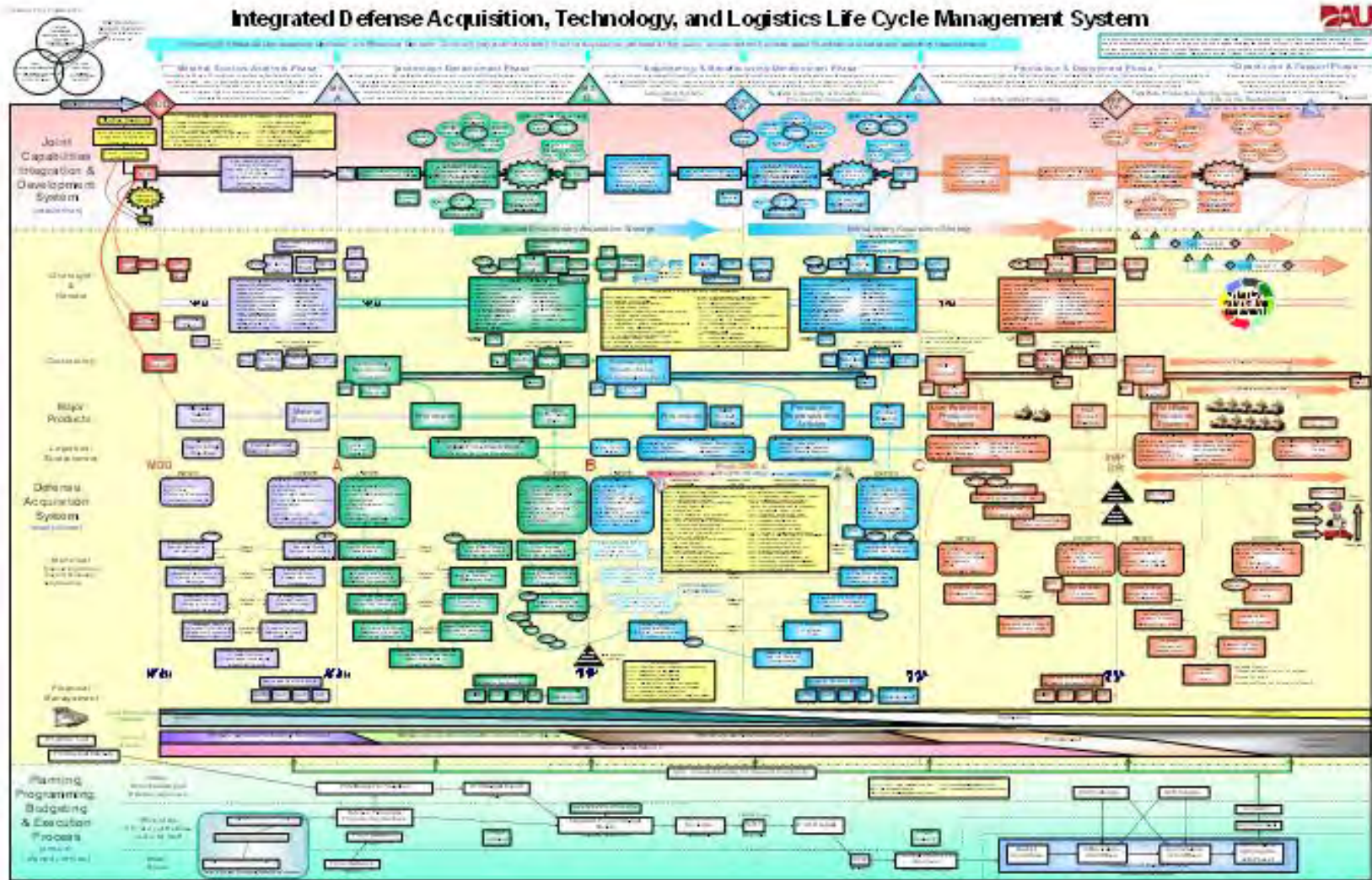
- Experimentation
- Red Teaming Analysis

Conceptualization

- Needs identification / lessons learned / assessment
- Tech push exploitation

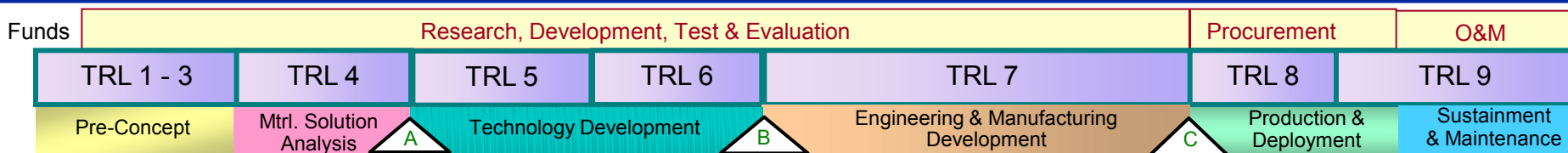


Defense Acquisition Process





ASD(R&E)Key Demonstration & Fielding Programs



Tech Demos for Irregular Warfare

Rapid Reaction Fund (RRF)

PE 0603826D8Z

New Breakthrough Capabilities to Operations

Biometrics & Forensics S&T

PE 0603665D8Z

Operational Experiments & Tech Integration for COCOMs & Interagency

Emerging Capabilities (EC)

PE 0603699D8Z

COCOM, Joint, Coalition & Interagency Capability Needs

Joint Capabilities Technology Demonstrations (JCTDs)

PE 0603648D8Z

"Gap-Filling" Technologies for OCO

Quick Reaction Funds (QRF)

PE 0603826D8Z

Assess Mature Technology from Coalition Industry

Foreign Comparative Testing (FCT)

PE 0605130D8Z

TRL: Technology Readiness Level
OCO: Overseas Contingency Operations



Rapid Reaction Fund (RRF)



- **Description**

- Identify & develop near-term capabilities to support irregular warfare needs within 6-18 months

- **Focus Areas**

- Unmanned autonomous systems and behaviors
- Evaluation of emerging commercial technologies for blue/red applications
- Addressing and responding to enhanced enemy capabilities
- ISR RDT&E architecture and integration venues
- Countering violent extremism
- Force Protection against advanced asymmetric threats

- **Participants:** COCOMs, Intel Community, Interagency, Services & Defense Agencies

Sea Stalker



Demonstrate an operational autonomous ISR capability that can be launched from submarines and surface platforms

Folded Wing Ready for Non-Pyrotechnic Launch

Fuel Cell Powered for Long Endurance ISR



Development of a hydrogen fuel cell powered asymmetrical unmanned aerial system for persistent surveillance



Joint Capability Technology Demonstrations (JCTDs)



- **Description**

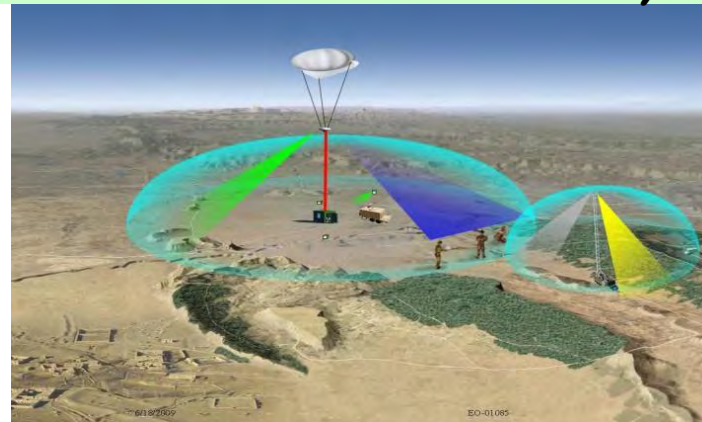
- Provide technology capability solutions through rapid prototyping to solve urgent joint, coalition, and inter-agency gaps
- Validated by Joint Staff and independent Military Utility Assessment

- **Focus Areas**

- Most pressing military needs as identified by COCOM's capability gaps, including Joint Urgent Operational Needs (JUONs) & Integrated Priority Lists (IPLs)
- Multiple new start opportunities annually to address emerging capability gaps within the budget period

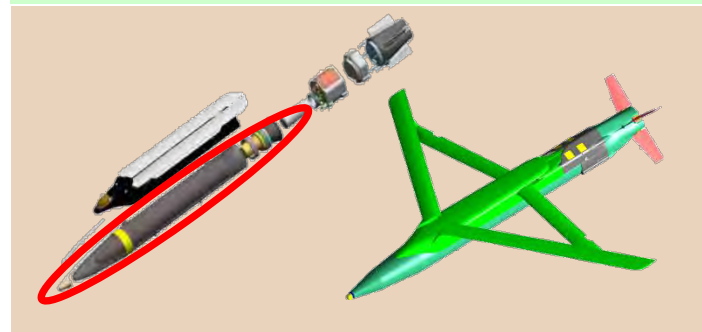
Participants: COCOMs, Coalition Partners, Services & Defense Agencies, Industry

Persistent Ground Surveillance Systems



Supports urgent need for persistent surveillance at forward operation bases in Afghanistan

Focused Lethality Munition



Demonstrate low collateral damage weapon - warhead with specialized fill to reduce frag & increase blast effects



Quick Reaction Fund (QRF)

- **Description**

- Funds high priority, short duration technology demos during execution year responding to new adversary threats
- Identify and develop near term capabilities to support conventional forces warfare urgent needs
- Efforts completed within 12 months

- **Focus Areas**

- Anti-Access Area Denial (FY 2012)

- **Participants**

- Project Sponsors & Execution: Services & Defense Agencies
- Efforts coordinated with Combatant Commanders / Joint Staff



Gunslinger

Modular, vehicle based, on-the-move hostile fire detection and counter-fire capability

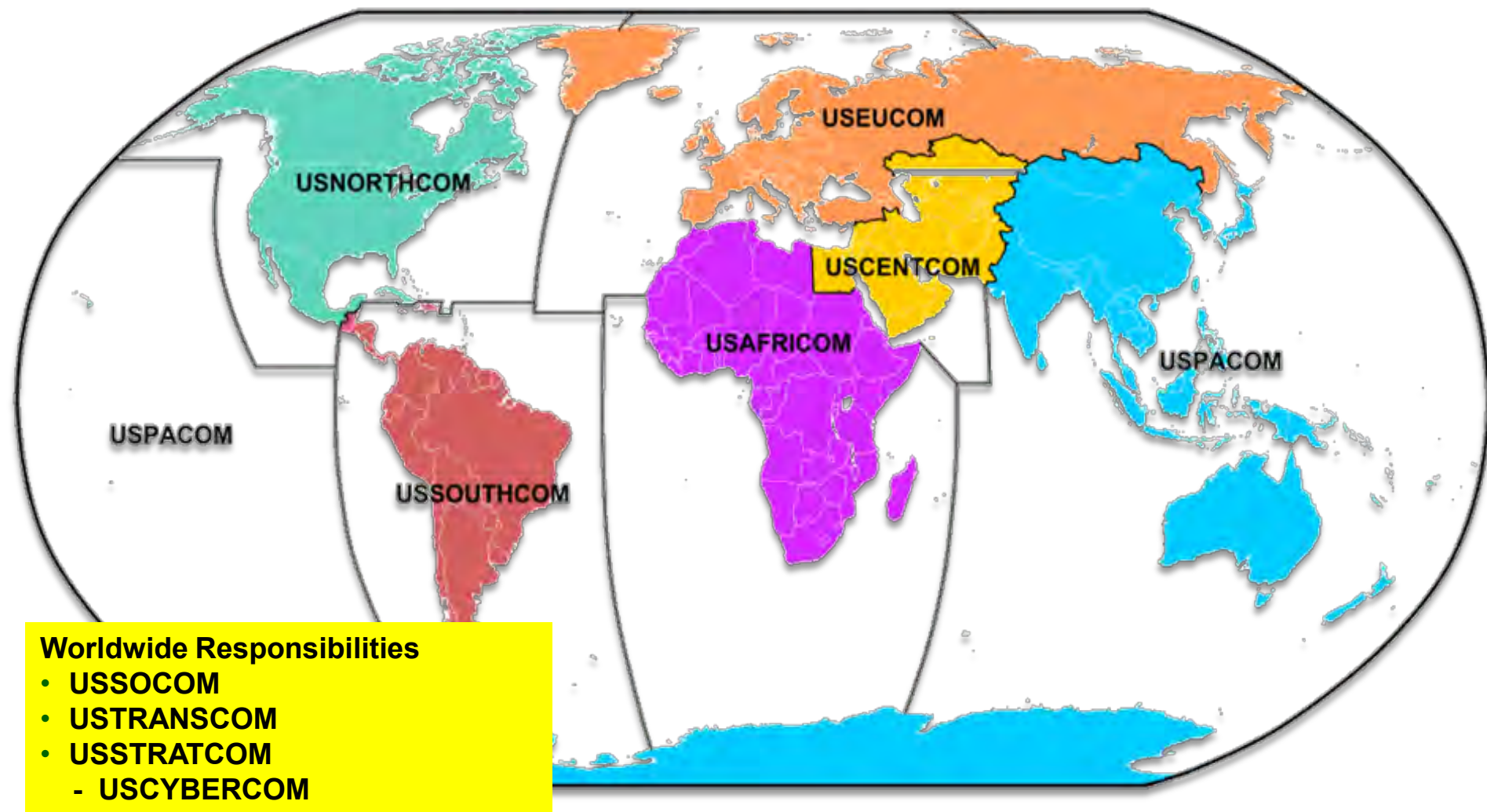
Deployable Satellite Communication System



Inflatable satellite antenna, designed to provide high-bandwidth SATCOM capability in a smaller, lighter package than conventional systems



Areas of Responsibility





Process Used to Develop the DoD Science & Technology Priorities June 21, 2011

***Mr. Bob Baker
Deputy Director, Plans & Programs
Assistant Secretary of Defense (Research & Engineering)***



Process Began With the 2010 QDR



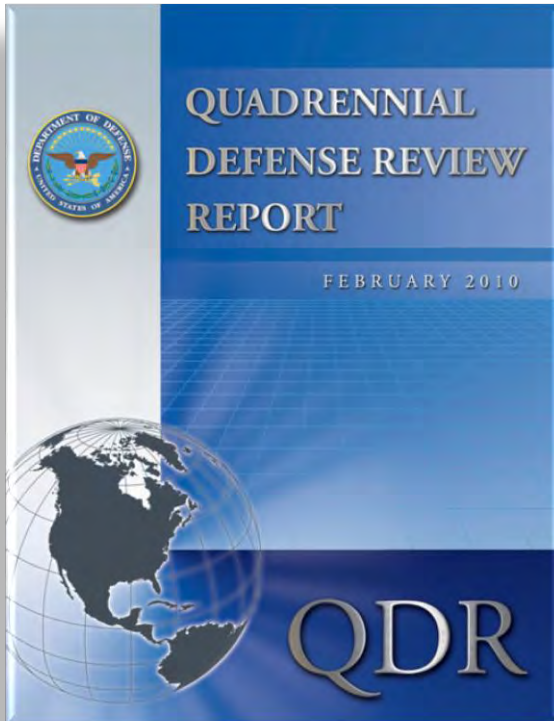
❑ The 2010 QDR identified 6 Key Mission Areas (KMAs) that DoD should build capability capacity to be successful in the future global security environment

- *Defend the United States and Support Civil Authorities at Home*
- *Succeed in Counterinsurgency, Stability, and Counterterrorist Operations*
- *Build the Security Capacity of Partner States*
- *Deter and Defeat Aggression in Anti-Access Environments*
- *Prevent Proliferation and Counter Weapons of Mass Destruction*
- *Operate Effectively in Cyberspace.*





QDR Key Mission Areas and Department Planning and Programming Guidance (DPPG) Tasking

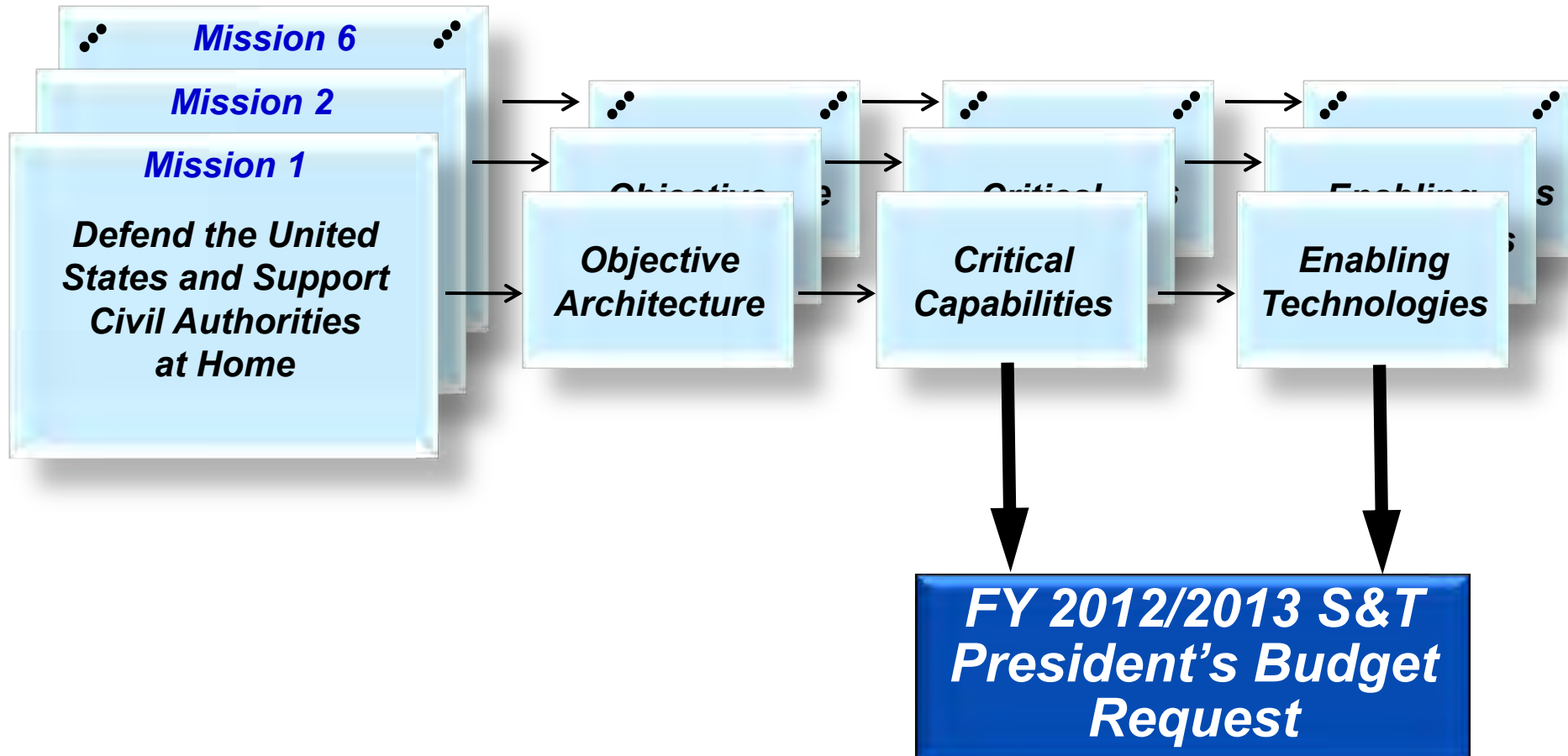


Key Mission Areas
Defend U.S. and Support Civil Authorities at Home
Succeed in COIN/Stability/CT Ops
Build Partner Security Capacity
Deter and Defeat Aggression in Anti-Access Environments
Prevent Proliferation and Counter WMD
Operate Effectively in Cyberspace

DPPG Task: “The DDR&E, with the support of the Secretaries of the Military Departments, Directors of the Defense Agencies, and CJCS will lead an effort across the Department to **identify the core capabilities and enabling technologies for each of the six QDR key mission areas.**”

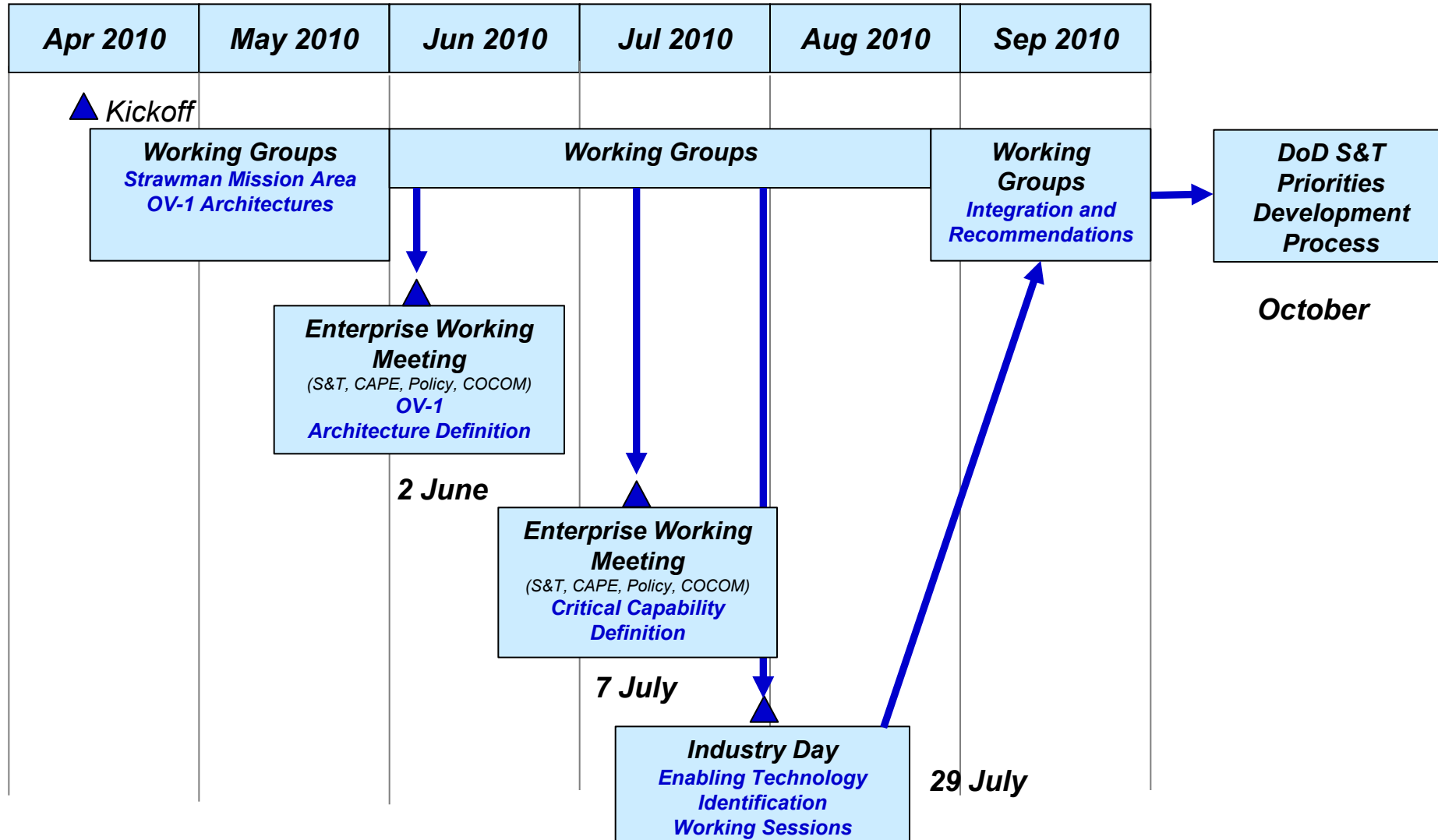


QDR KMA Study Approach





QDR KMA Study Timeline





Single-Service Led S&T Priorities



- **Army**
 - Immersive Training
- **Navy**
 - Undersea Warfare
- **Air Force**
 - Long Range Strike
 - Affordable Space Access

Note: The QDR KMAs are additive to core military missions and competencies assigned to the armed forces



Initial S&T Priorities - 54 Total - Reduced to 7 -



- **QDR KMA DPPG Study:**
 - Data to Decisions
 - Systems 2020
 - Immersive Training
 - Autonomy for Standoff, Speed & Scale
 - Human Terrain Preparation
 - CBRN Standoff Detection, Locate, Monitor & Track
 - Cyber Mission Assurance/Dominance -Includes Trust & Attribution
 - Rapidly Tailored Effects
 - EM Spectrum Management
 - Knowledge and Information Management / Architecture
 - Ubiquitous Observation
 - Access and Sharing of DoD Information/Databases
 - Alternatives to GPS for providing PNT
 - Contextual Exploitation
- **TFTs and COIs:**
 - High Speed / Hypersonics



Initial S&T Priorities - 54 Total - Reduced to 7 (contd.) -



- **TFTs and COIs (contd.)**
 - Highly Adaptive Turbine Engines
 - Multi Role Vertical Lift
 - Reasoning Machines
 - Teaming Large Numbers of Autonomous Hetero. Systems
 - Developing Materials Underpinning Electronics Technologies
 - Force Protection
 - Mobility
 - Integrated Computational Materials Science and Engineering (ICMSE)
 - Complex Engineered Materials
 - Improved Kinetic Weapons
- **Service and Agency Priorities**
 - Autonomy
 - Power & Energy
 - Total Ownership Cost
 - Directed Energy
 - Educational Outreach/STEM



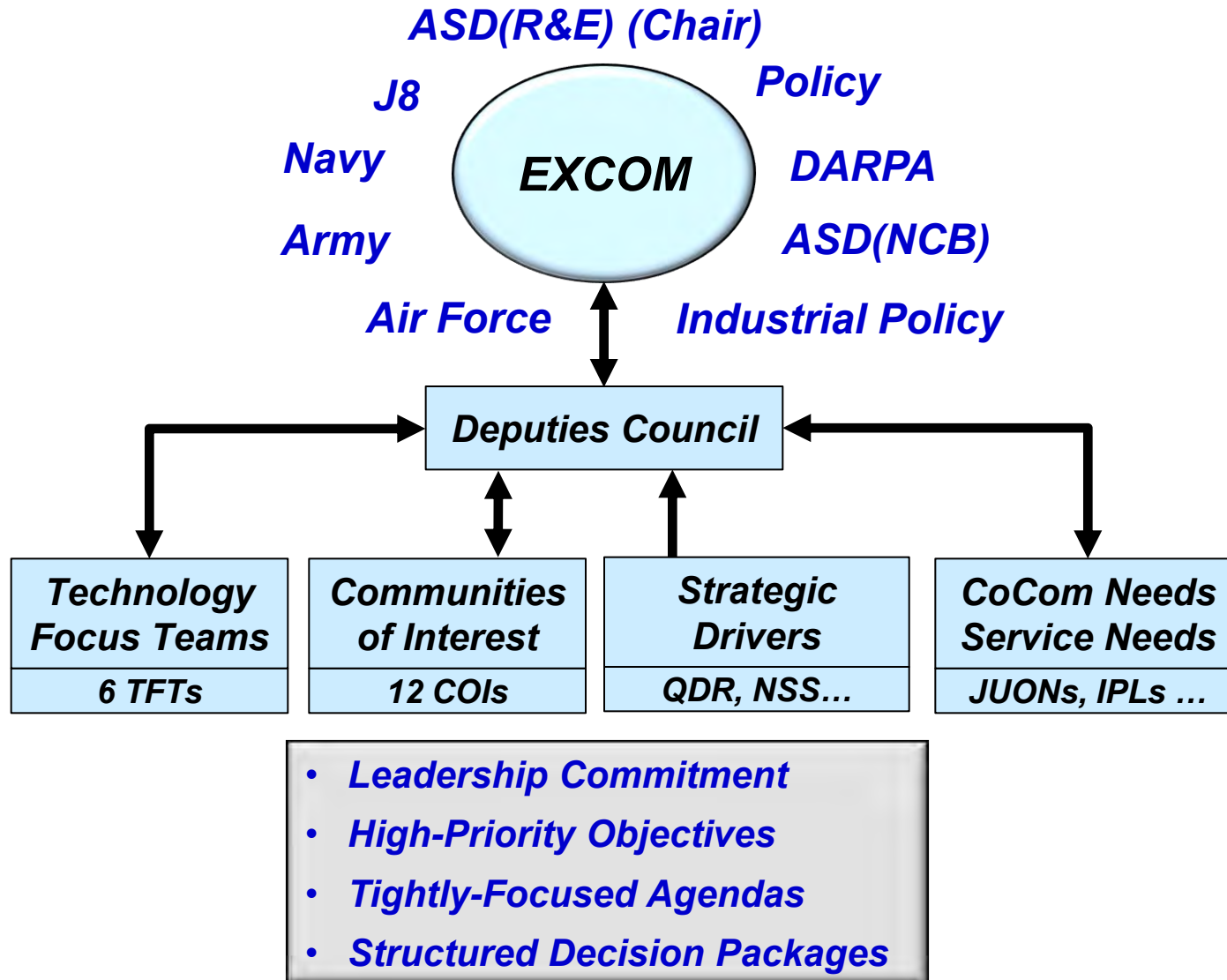
Initial S&T Priorities - 54 Total - Reduced to 7 (contd.) -



- **Service and Agency Priorities (contd.)**
 - Irregular Warfare/Counter IED
 - Undersea Warfare
 - Electronic Warfare/Electronic Protection
 - Improved Situation Awareness, Persistent ISR
 - Climate Change and the Arctic
 - Long-Range Strike
 - Medical PTSD/TBI, Blast/Trauma
 - Enhanced Cognitive Performance
 - Software Assurance
 - Rare Earth Element Technologies
 - Small Engines/Alternate Propulsion
 - Military-Unique Fixed-Wing and Rotary-Wing Technologies
 - Human System
 - Affordable Space Access
 - Precision lethality
 - Counter-WMD Technologies (9 total that were consolidated to 1)



Implementation Forum: S&T Executive Committee





S&T Executive Committee (EXCOM)



***Lt Gen Larry Spencer
J8***



***Ms. Kathleen Hicks
DUSD(SPF)***



***Mr. Zach Lemnios
ASD(R&E)***



***Mr. Andrew Weber
ASD(NCB)***



***Mr. Brett Lambert
DASD(MIBP)***



***Dr. Regina Dugan
DARPA***



***Dr. Steven Walker
DASAF(STE)***



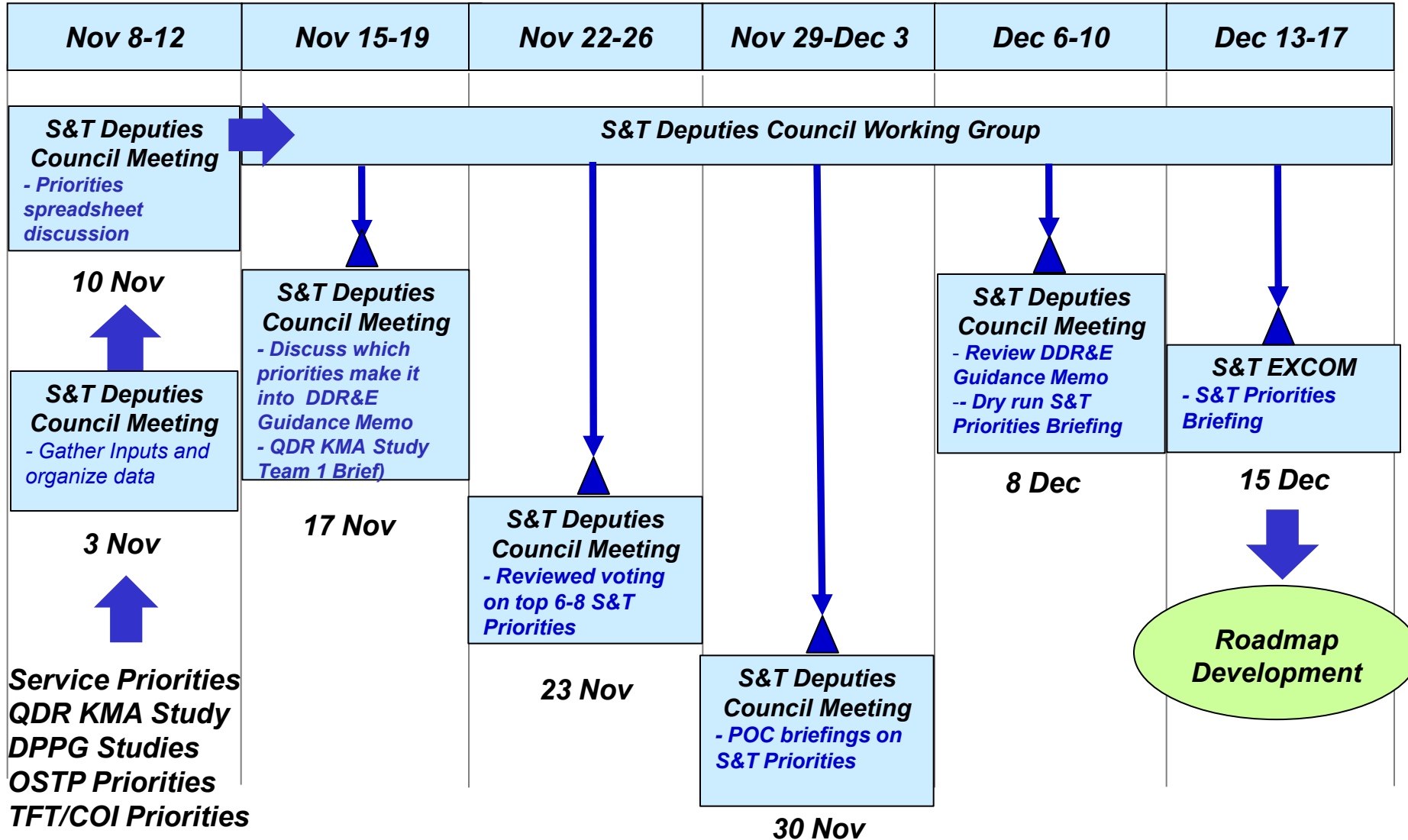
***Dr. Marilyn Freeman
SAAL-ZT***



***RADM Nevin Carr
CNR***



FY 2013 S&T Priorities Timeline





Secretary of Defense S&T Priorities Memo – Apr 19, 2011



S&T Priorities

- **Data-to-Decisions**
- **Engineered Resilient Systems**
- **Cyber Science and Technology**
- **Electronic Warfare / Electronic Protection**
- **Counter Weapons of Mass Destruction**
- **Autonomy**
- **Human Systems**

The Assistant Secretary of Defense for Research and Engineering, with the Department's S&T Executive Committee and other stakeholders, will oversee the development of implementation roadmaps for each priority area. These roadmaps will coordinate Component investments in the priority areas to accelerate the development and delivery of capabilities consistent with these priorities.

Robert M. Gates



SECRETARY OF DEFENSE
1000 DEFENSE PENTAGON
WASHINGTON, DC 20301-1000

APR 19 2011

MEMORANDUM FOR SECRETARIES OF THE MILITARY DEPARTMENTS
CHAIRMAN OF THE JOINT CHIEFS OF STAFF
UNDER SECRETARY OF DEFENSE FOR ACQUISITION,
TECHNOLOGY AND LOGISTICS
ASSISTANT SECRETARY OF DEFENSE FOR RESEARCH
AND ENGINEERING
DIRECTORS OF THE DEFENSE AGENCIES

SUBJECT: Science and Technology (S&T) Priorities for Fiscal Years 2013-17 Planning

The Department's S&T leadership, led by the Assistant Secretary of Defense for Research and Engineering, in close coordination with leadership from the Under Secretary of Defense for Policy, the Assistant Secretary of Defense for Nuclear, Chemical, and Biological Defense, the Deputy Assistant Secretary of Defense for Manufacturing and Industrial Base Policy, and the Joint Staff, has identified seven strategic investment priorities. These S&T priorities derive from a comprehensive analysis of recommendations resulting from the Quadrennial Defense Review mission architecture studies directed in the FY12-16 Defense Planning Programming Guidance.

The priority S&T investment areas in the FY13-17 Program Objective Memorandum are:

- (1) **Data to Decisions** – science and applications to reduce the cycle time and manpower requirements for analysis and use of large data sets.
- (2) **Engineered Resilient Systems** – engineering concepts, science, and design tools to protect against malicious compromise of weapon systems and to develop agile manufacturing for trusted and assured defense systems.
- (3) **Cyber Science and Technology** – science and technology for efficient, effective cyber capabilities across the spectrum of joint operations.
- (4) **Electronic Warfare / Electronic Protection** – new concepts and technology to protect systems and extend capabilities across the electro-magnetic spectrum.
- (5) **Counter Weapons of Mass Destruction (WMD)** – advances in DoD's ability to locate, secure, monitor, tag, track, interdict, eliminate and attribute WMD weapons and materials.
- (6) **Autonomy** – science and technology to achieve autonomous systems that reliably and safely accomplish complex tasks, in all environments.
- (7) **Human Systems** – science and technology to enhance human-machine interfaces to increase productivity and effectiveness across a broad range of missions.



“The Assistant Secretary of Defense for Research and Engineering, with the Department's S&T Executive Committee and other stakeholders, will oversee the development of implementation roadmaps for each priority. These roadmaps will coordinate Component investments in the priority areas to accelerate the development and delivery of capabilities consistent with these priorities.”



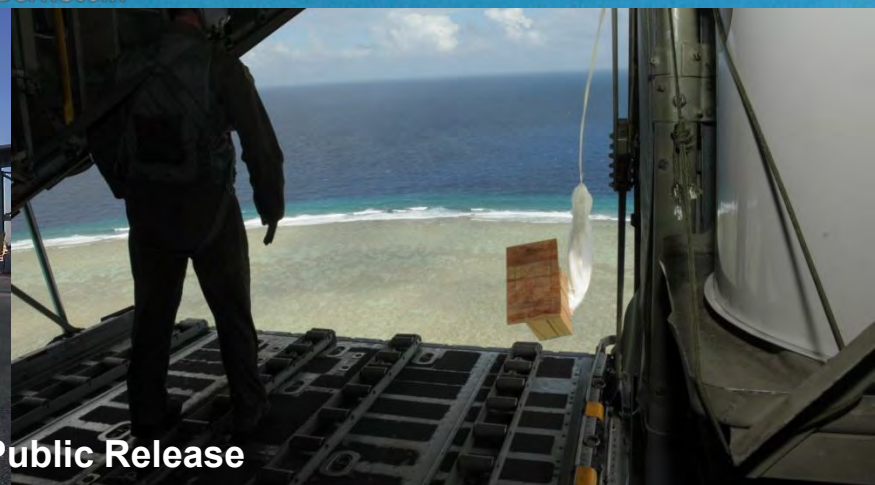
Priority S&T Investment Areas for FY 2013-2017



- **Data-to-Decisions**
 - Science and applications to reduce the cycle time and manpower requirements for analyses and use of large data sets.
- **Engineered Resilient Systems**
 - Engineering concepts, science, and design tools to protect against malicious compromise of weapon systems, and to develop agile manufacturing for trusted and assured defense systems.
- **Cyber Science and Technology**
 - Science and technology for efficient, effective cyber capabilities across the spectrum of joint operations.
- **Electronic warfare / Electronic protection**
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 - Science and technology to achieve autonomous systems that reliably and safely accomplish complex tasks in all environments.
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 - Science and technology to enhance human-machine interfaces to increase productivity and effectiveness across a broad range of missions.



USTRANSCOM
Operational and Technology Challenges Brief
to
Science & Engineering Technology Conference/DOD Tech Expo
Mr. Lou Bernstein



Approved for Public Release



Purpose



- **Role/Mission**
- **Logistics Transformation Imperative**
- **Top Operational/Technology Challenges**
- **RDT&E Program Overview/Project Highlights**



USTRANSCOM Transformation



2011– Global Distribution Synchronizer

2007 – DPO lead for DOD Supply Chain RFID/AIT implementation

2005 – Full Time US Transportation Command Commander

2003 – Distribution Process Owner Established

1993 – US Transportation Command Charter (Peacetime/Wartime Strategic Mobility)

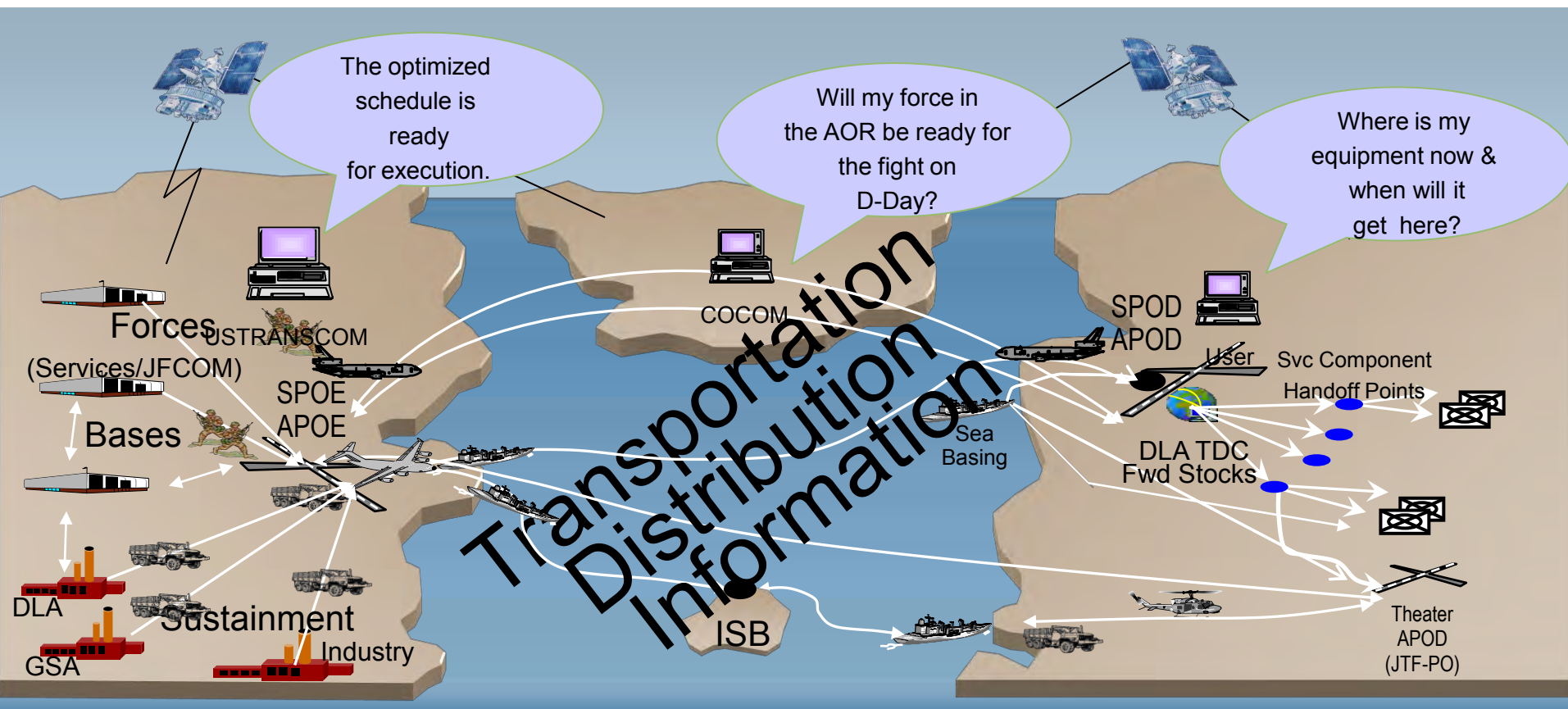
1990 – DESERT SHIELD/STORM

1987 – US Transportation Command Established

1986 – Goldwater/Nichols Act



USTRANSCOM's End-to-End Mission



Leveraging S&T to Transform Logistics Support to the Warfighter and Ensure the Development of Affordable Solutions



Operating in a Global Environment...



Combatant Commander Plans...

- Rely on Austere Infrastructure
- Demand Rapid Force Projection
- Require Early Diplomatic Coordination
- Incorporate Civil-Military Support
- Pose Force Protection Threat

Challenges

Roads/Rail

Ports

No Fuel

Runways

Diplomatic
Clearances

No MHE/CHE

Limited
Nav aids

Poor
Construction

Access!!

High Threat

...that places a premium on Collaboration



DOD's Logistics Strategic Vision



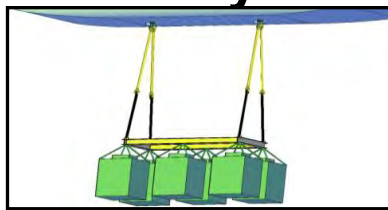
- **DOD Logistics Goals**
 - *Effective logistics support to current ops*
 - Effective management of contractors on the battlefield
 - Integrate life cycle management principles
 - *Integrate supply chain to point of consumption*
- ***Deliver integrated joint logistics capabilities***
- ***Network/Optimize the Joint Logistics Enterprise***
- ***Ensure Rapid, Precise Response***

Note: USTRANSCOM RDT&E program affects italicized areas

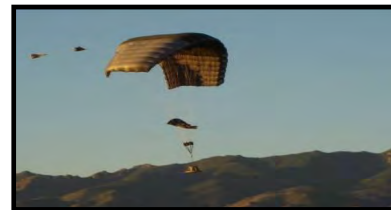




High Speed Container Delivery



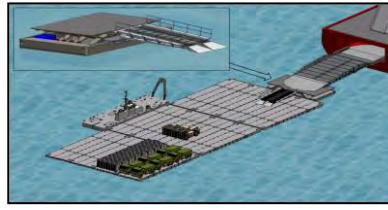
Helicopter Sling Load - JPADS



JPADS-Guidance/Navigation/Control

The diagram illustrates the INLS Module assembly. It consists of three main components: the MCS Module (a long, thin, grey rectangular block), the INLS Module (a yellow rectangular block), and the JUCIM (a black rectangular block). Arrows point from the labels to their respective components in the assembly.

Joint Universal Causeway Interface Module



Com'l Roll-on/Roll-off Interface Platform



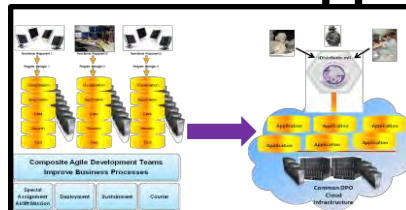
Sea Base Enablers

The diagram illustrates the Event-driven Analytics Architecture, centered around an **Event Manager** (a blue box with a white 'X').

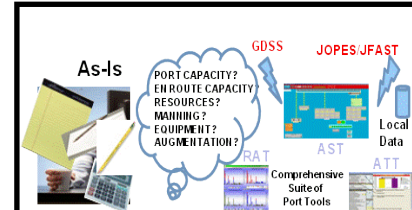
- Top-Left: "Where is it?" (Geospatial Visualizations)**
 - Inputs: **Streams** (represented by a cylinder icon) and **Log-based Visualizations** (represented by a cylinder icon).
 - Output: **Geospatial Visualizations** (represented by a map of the US with data points).
- Top-Right: "What's next?" (Collaborative Analytics)**
 - Input: **Streams** (represented by a cylinder icon).
 - Output: **Collaborative Analytics** (represented by a network diagram).
- Bottom-Left: "What is it?" (Event Manager)**
 - Input: **Streams** (represented by a cylinder icon) and **Log-based Visualizations** (represented by a cylinder icon).
 - Output: **Event Manager** (represented by a list of events).
- Bottom-Right: "What is it?" (Metrics)**
 - Input: **Streams** (represented by a cylinder icon).
 - Output: **Metrics** (represented by a bar chart).

The central **Event Manager** is connected to all four quadrants. Below the **Event Manager** is a **Widgets** section, which is a dashboard displaying various charts and maps. The entire architecture is supported by a **Data Lake** at the bottom, which is connected to various data sources like **Social Media**, **Log Files**, and **Sensors**.

Situational Awareness & Collaboration

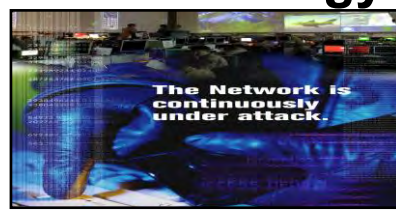


Computing Environment

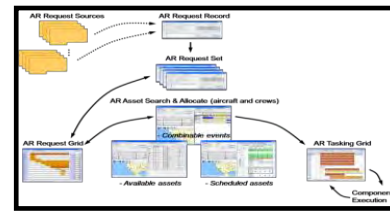


AT21/Decision Support

Unmanned Air Systems/Hybrid



Cyberspace/Security



Support Planning for Aerial Refueling

**See USTCH60-2
for complete list**

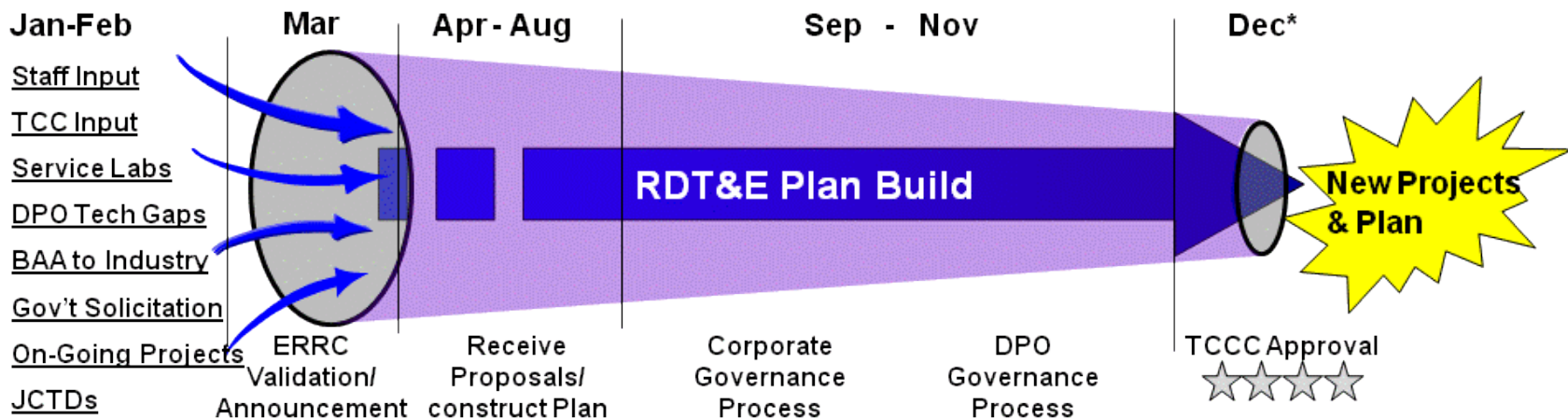
www.transcom.mil/rdte



Program Summary



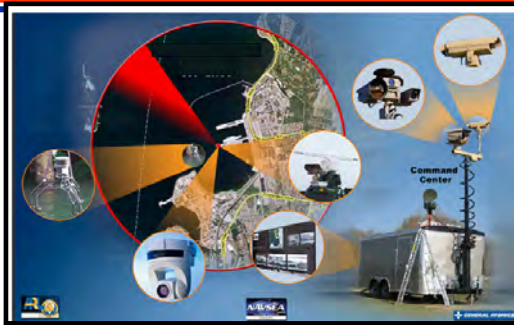
	FY12	FY13	FY14	FY15	FY16	FY17
Current Top Line	\$43M	\$34.2M	\$38M	\$38.3M	\$39.2M	\$43.1M



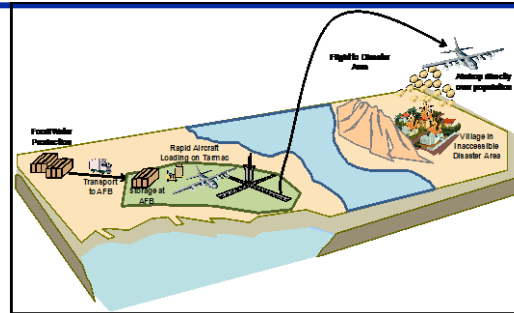
*OSD RDT&E budget exhibit submissions drives timeline

Leveraged over \$285M in Service/OSD/Defense Agency RDT&E contributions (FY06-11) – 7:1 ROI

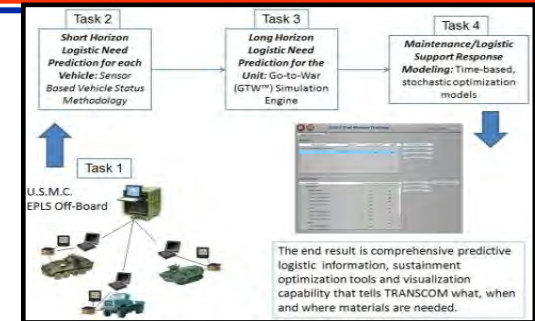




Force Protection/Security



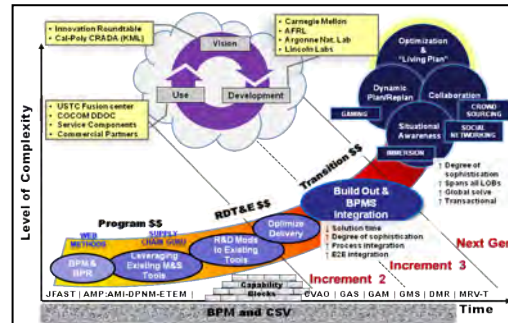
Humanitarian Airdrop Over Populated Areas



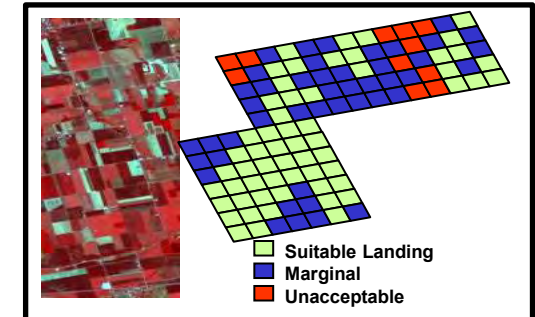
Sense and Respond Logistics



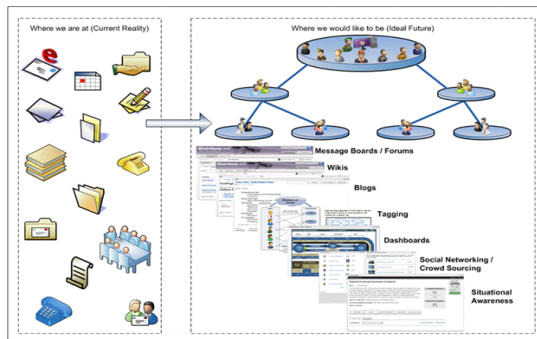
Improved Accuracy at Point of Need



Optimization



Rapid/Automated Landing Site Detection



Collaboration and Integration



Port Efficiency Enhancements



Sea Based Enablers



USTRANSCOM Technology Transfer Activities

(Office of Research and Technology Applications)



**Knowledge Management--
Service-Oriented Architectures**



Airships and Hybrid Airships



Satellite RFID



**Advanced Decision-making
Tools for the Supply Chain**



**Cloud Computing and
Data Quality**

**Over \$7.5M of Industry
Investment**



**Wind Farm Effects on Radar
Performance**



**Science, Technology
Engineering & Mathematics**



**Remotely Piloted Vehicles
For Cargo Transport**



We Measure Success Through the Eyes of the Warfighter & the Taxpayer!



Backups



Selected Benefits (completed efforts)



- **End to End Distribution Model**
 - Halved MCRS-16 simulation run-times; simulate all portions of deployment & distribution
 - Provided the data to support USAF decision to retire 22 C-5A
- **Joint Modular Intermodal Container: \$16M/yr savings w/cardboard uni-pack**
- **Defense Distribution Expeditionary Depot**
 - Significant reduction in military inter-theater airlift for DLA managed items
 - Customer Wait Time reduced from 19.8 days to 10.8 days
- **Coalition Mobility System: 100% ROI within 2 years and \$2.3M/yr thereafter**
- **Common Operating Picture (Deployment and Distribution)**
 - ID of top 100 heaviest airlifted items saving \$54M annually in transportation costs
 - Delivered initial iDistribute.mil capabilities (i.e., workspace mgmt, collaboration, etc.)
- **En Route Patient Care Module**
 - Less people managing more patients/continued intervention in absence of skilled caregiver
 - Closed loop system provides ~40% reduction in O2 use over current manual methods
- **JPADS – Mission Planner: 80% reduction in recovery ops/cost & saves lives**
- **JPADS Next Generation Guidance, Navigation & Control**
 - Enhanced accuracy (< 50 meters) integrated into 2K JPADS assets; Reduce DZ by 20%
 - Reduce IED exposed convoys, safer recovery ops, increased personnel survivability
- **Low Cost Low Altitude: Reduce airdrop asset recovery/improves safety (less grnd convoys)**



Selected Benefits (completed efforts)



- **Wireless Gate Release System**
 - Doubles C-130 delivery capacity (FOC 4QFY11) (saving fuel/acft wear & tear/assoc costs)
 - Eliminates bundle damage due leap frogging (effects 20% of airdropped bundles)
- **Joint Recovery and Distribution System**
 - 101st Sustainment Brigade employing three 40T vehicles - completed < dozen missions in Afghanistan to date
 - USMC to deploy four 34T vehicles (per HQMC current trailer is unsuited for Afghan rugged off road conditions-- looking to purchase another 10 to fill Urgent Universal Needs Statement)
- **Seabasing**
 - Joint Universal Causeway Interface Module: Universal connector (vice spending \$246M to replace Army Modular Causeway System and Improved Navy Lighterage System)
 - Commercial Roll-on/Roll-off Interface Platform: Provide non-existent capability to off-load commercial RO/ROs at sea – enhanced operational flexibility/could reduce sealift recap bill
 - Shipboard Selective Access and Retrieval System
 - 67% reduction in manpower required to move vehicles and containers (typically 6 to 2)
 - Improved storage (omni-directional access/movement) of mission assets
 - MHE fuel usage is cut by 67% for RO/RO operations and 100% eliminated for flat-deck operations (due use of battery/hybrid diesel/electro-hydraulic drives)
- **Next Generation Autonomic Logistics/Predictive Analysis: Will improve sustainment forecasting and enable best cost transportation solutions**



Selected Benefits (ongoing efforts)



- **Cyber**
 - Computer Adaptive Network Defense-in-Depth: Provided DOD the ability to continue critical network operations in a contested NIPR/SIPR network environments via secure enclaves
 - Cross Domain Collaborative Information Exchange: Provide bi-directional transfer across NIPR/SIPR domain for the Joint Deployment & Distribution Enterprise
- **Humanitarian Assistance Visibility Experiment/Humanitarian Expeditionary Log Project**
 - Qualified ROI is a cost savings of \$147,000 (\$15.00/hr x 35 hours x 70 operating days x 4 sites) and a twelvefold improvement in data visibility (from once every 12 hours to once every hour)
 - Historical example from 2008 Hurricane Ike - capability would have resulted in a cost avoidance of \$5M to the taxpayer in one incident in which 450 truckloads of ice were procured and destroyed because resource visibility was nil)
- **Next Generation Wireless Communications: Army G4 draft BCA determined break even point in 2 years and ~33% out-year lower costs over current \$619M-10 yr aRFID solution**
- **Support Planning for Air Refueling: Potential \$265M/yr savings at \$3/gal**



Selected Benefits (ongoing efforts)



- **AT21/Living Plan: Combined (TWCF/RDT&E) \$884M (FY07-26) cost savings**
 - Movement Requirements Visibility-Theater: Better utilization of common user movement assets in theater is expected to provide at least a \$16.7M annual cost avoidance
 - Distribution Process Nodal Model: Improve Time Definite Delivery by 10 – 15%
 - End to End Distribution Modeling: Reduce model setup and runtime by 20%; Economic Analysis states breakeven year to be FY17 (AT21 enabler)
 - Global Mission Scheduling: TACC tool to dynamically re-plan (est. cost avoidance of \$6.38M/yr due more efficient use of assets/fuel savings/reduced mission support requirements/etc.)
 - Cognitive Visualization, Alerting and Optimization: Reduces time to generate multiple COAs and develop optimized solution among multiple stakeholders
 - Situational Awareness & Collaboration: Better warfighter support via improved organizational unity of effort and efficiencies thru common operational SA and networked collaborative capabilities for JDDE stakeholders
 - Enterprise Integration Lab: Mitigate technical risk and accelerated capability fielding via comprehensive functional and certification/accreditation testing
 - Dynamic Re-planning Nodal Management Air
 - Provide standard, objective, repeatable method to assess airport capacity and flow requirements
 - \$0.9M/yr savings/cost avoidance (conservative estimate)
 - Could realize similar savings from seaport – providing additional \$400K in FY13 to explore/assess



Selected Benefits (ongoing efforts)



- **Point of Need Delivery: No costs savings/just better warfighting capability**
 - JPADS Helicopter Sling Load: Increased operational flexibility/agility – enhanced safety (crew/helo as well as reduction in ground convoys)
 - High Speed Container Delivery System: Enhanced aircrew/aircraft survivability (70% reduction in exposure to ground threat due fast ingress/egress) while increasing accuracy of resupply (due delivery at lower altitude and higher airspeed) as well as volume (from < 2200 lbs to > 16,000 lbs)
 - Autonomous Technologies for Unmanned Air Systems: Ability to provide precision delivery (via sling load) in anti-access/austere/urban environments (minimizes risk to ground troops, eliminates pilot/aircrew from resupply equation, provides field retrograde capability). Hand-held beacon to eliminate need for forward air controllers/ground stations.

Minimum 7:1 ROI – Program Pays for Itself



NDIA Science and Engineering Technology Conference



NAVSEA Technology Needs


June 2011

Michael L. Bosworth
SEA 05T, Chief Technology Officer (acting)
Michael.bosworth@navy.mil











NAVSEA Organization (made simple)

NAVSEA Commander VADM McCoy
Vice Cdr Executive Director Staff


Program Executive Offices (PEOs)

- Ships 
- Submarines 
- Aircraft Carriers 
- Integrated Warfare Systems 
- Littoral and Mine Warfare >>>
to Littoral Combat Ship (soon) 

Headquarters Directorates

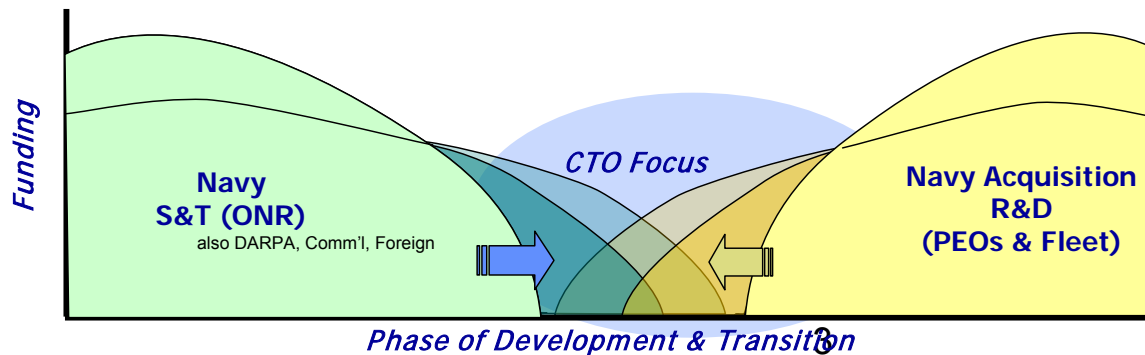
- Most notably for this venue
SEA 04 (with naval shipyards, supships)
SEA 05 (Naval Systems Engineering)
with a dozen tech groups of which
one is 05T (Technology ie R&D) 

Naval Labs

- NSWC  (surface)
- NUWC  (undersea)

SEA 05 Technology Office (SEA 05T)

- Serve as Primary SEA 05 R&D and Technology Transition Staff
- Focus on transitioning technology from S&T to the Acquisition Programs and Fleet
- Manage assigned R&D Programs
- Develop a workforce that can effectively lead and transition technology into the fleet
- Partner with S&T Community, Industry, Acquisition Community, and the Fleet to produce technology development strategies and transition technology into the fleet



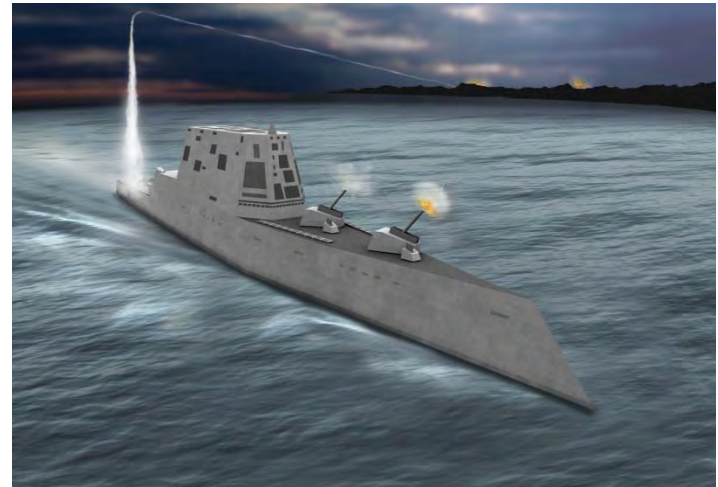
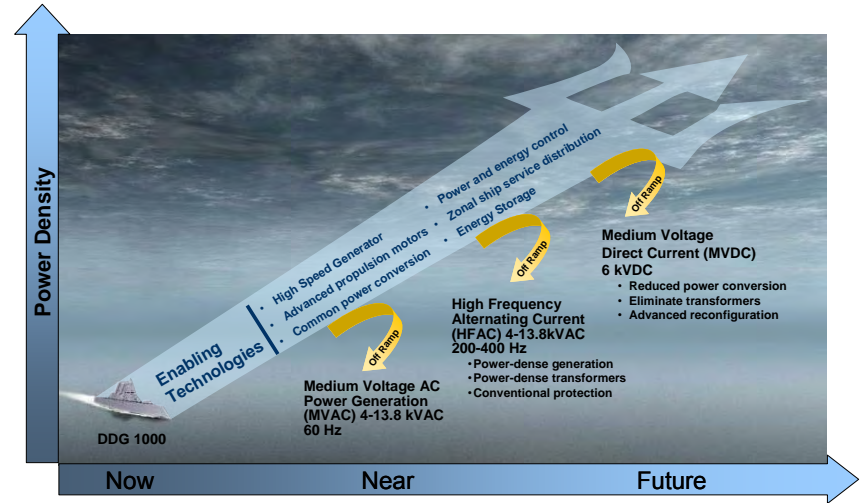


Naval Technology Needs for Today's Fleet

- Technologies promoting the ability to affordably modernize to meet evolving threats
 - Open Architecture
 - Modularity
 - Increased Distributed System Capacity (electrical power, chill water, etc.)
 - Ability to interface with new aircraft (MV-22, JSF, etc.)
 - Ability to interface with off-board unmanned systems.
- Technologies that improve material condition of ships
 - Corrosion Control
 - Reliability improvements
- Technologies that reduce the Total Ownership Cost of Today's Fleet
 - Energy Efficiency
 - Reduced Manning
 - Improved training methods
- Analytical Methods to enable calculating Return on Investment of Open Architecture and Modularity
 - “Real Options”

Naval Technology Needs for the Future Fleet

- Architecture driven Product Lines
 - Next Generation Integrated Power Systems
 - HVAC 21st Century
 - Open Architecture Combat Systems
- Affordable incorporation of evolving technologies
 - Railguns and Directed Energy Weapons
 - Unmanned Vehicles and Autonomy
 - New Aircraft (shipboard integration of...)
- Improved Design methods and tools
 - Ship Design Process Modeling
 - Properly Pricing Risk
 - Properly Valuing Flexibility
 - Design, Costing & Analysis Tools
- Total Ownership Cost Reduction Technologies
- Mission Effectiveness Technologies
- Improved Technology Transition Model



***Need affordable robustness
in a changing world***

Generalities...what about specifics?

- The transition opportunities are in the acquisition shops (PEOs).
- FOR SHIPS: Look at annual 30 year Shipbuilding Plan.
 - one on-line source:
<http://www.militarytimes.com/static/projects/pages/2011shipbuilding.pdf>
- Backup from the first of class 'award date' to early design.
- Have a new capability/technology 'ready for transition' as design concepts are being developed, competed, selected.

Fiscal Year	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
Aircraft Carrier			1					1					1					1					1					1		
Large Surface Combatant	2	1	2	1	2	1	2	1	2	1	2	1	2	1	1	2	2	1	2	1	2	2	2	2	2	2	2	2	2	2
Small Surface Combatant	2	3	4	4	4	3	3	3	3	2	2	2	2	2	1	2	1	2	1	2	1	2	1	2	2	2	2	2	2	2
Attack Submarines	2	2	2	2	2	2	2	1	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	2	1	2	1	2	
Ballistic Missile Submarines									1			1		1	1	1	1	1	1	1	1	1	1							
Amphibious Warfare Ships	1	1				1	1		1		2	1		2		1		1		2		1			1		1	1	1	
Combat Logistics Force							1		1		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1		1		1	
Support Vessels	2	1	3	2	4	2	3	3	3	4	2	3	3	2	1			1		2	1	1	2	2	2	2	2	2	2	2
Total New Construction Plan	9	8	12	9	12	9	12	9	13	9	11	10	11	8	8	7	7	8	8	8	8	8	11	8	10	7	10	9	10	7

- Less centralized data for warfare systems, HM&E & logistics systems, boats/craft/unmanned vehicles.

30yr Ship-Building Plan

SHIPS:

DDG51
DDG(X)
LHD(X)
LSD(X)
T-AO
T-ARS(X)
T-AGOS(X)
AS(X)
SSC
LCS
LCS(X)

POC: Glen Sturtevant
Glen.Sturtevant@navy.mil

SUBs:

SSBN(X)
Ohio Replacement
SSN - Virginia

POC: Regan Campbell
Regan.Campbell@navy.mil

CARRIERS:

CVN21

POC: Eric Pitt
Eric.Pitt@navy.mil

Near Term Technology For Today's Fleet

Pacing Evolving Threats:

Open Architecture
Modularity
Distributed Systems
UV Interfaces

Operating Cost Reduction:

Energy Efficiency
Automation
Improved Crew Training

Lifecycle Cost Reduction:

Low Maintenance Materials
Remote CBM
Reduce/Eliminate Corrosion
Software Reconfigurability

Lifecycle Cost Reduction*:

*additional to ones listed above

In Water Repairable Systems

Pacing Evolving Threats*:

*additional to ones listed above

New Aircraft Interfaces

Far Term Technology For The Future Fleet

Architecture Driven Product Lines:

NGIPS
HVAC 21st Century
Open Architecture

Disruptive Technology:

Directed Energy Weapons
EM Railgun
UVs

New Design & Analysis Tools:

Ship Design Process Modeling
Pricing Risk
Quantifying/Valuing Flexibility
CREATE

Disruptive Technology:

Large Diameter Tube Payloads

Disruptive Technology*:

*additional to ones listed above

New Aircraft



**Capable,
Affordable,
Sustainable
Fleet of 313**



Summary

- Technology & Innovation for Ships, Boats, Unmanned Vehicles & the systems that integrate into them....for **warfighting mission payoff**.
- **Affordable** (crisis of cost).
- **Transitionable** (crisis of productization).
- Utilize existing in new configurations (to be affordable & transitionable)





Contact Info:

Michael L. Bosworth

Chief Technology Officer (acting)

NAVSEA 05T

michael.bosworth@navy.mil

Jerome Dunn

S&T Programs Officer

NAVSEA 05T1S

jerome.dunn@navy.mil

NAVSEA 05 - Naval Systems Engineering Directorate

SEA 05C - Cost Engineering & Industrial Analysis

SEA 05D - Surface Ship Design & Systems Engineering

SEA 05H - Integrated Warfare Systems Engineering

SEA 05L - Littoral and Mine Warfare Design & Systems Engineering

SEA 05P - Ship Integrity & Performance Engineering

SEA 05S - Command Standards

[SEA 05T - Technology](#)

SEA 05U - Submarine/Submersible Design & Systems Engineering

SEA 05V - Aircraft Carrier Design & Systems Engineering

SEA 05X - University Affiliated Research Center

SEA 05Z - Marine Engineering

SEA 04 - Logistics, Maintenance, and Independent Operations

SEA 07 - Undersea Warfare

SEA 08 - Nuclear Propulsion

SEA 21 - Surface Warfare

PEO Carriers

POC: Eric Pitt

Eric.Pitt@navy.mil

PEO Integrated Warfare Systems

POC: Doug Marker

Douglas.Marker@navy.mil

PEO Littoral & Mine Warfare

POC: Megan Cramer

Megan.Cramer@navy.mil

PEO Ships

POC: Glen Sturtevant

Glen.Sturtevant@navy.mil

PEO Subs

POC: Regan Campbell

Regan.Campbell@navy.mil



AFRL Precision Air Drop

Keith B. Bowman, PhD, PE
Plans and Programs Directorate
Air Force Research Laboratory
Keith.bowman@wpafb.af.mil



Air Drop by the Numbers

60,400,000

Pounds dropped in 2010, 99+% CDS (\$2.5K/bundle)

<100,000

Pounds dropped in 2010, guided systems (\$30+K/bundle)

250

**Distance to impact point (in meters) considered an
“acceptable” drop**

<50

Desired distance to impact point (in meters)



Air Drop Focus Areas

“AMC has a need to provide aerial delivery of a broad range of assets with superb accuracy from extended airdrop offset distances and higher altitudes. Single pass capability solutions should be considered...” Gen Raymond Johns, Commander AMC, 2011

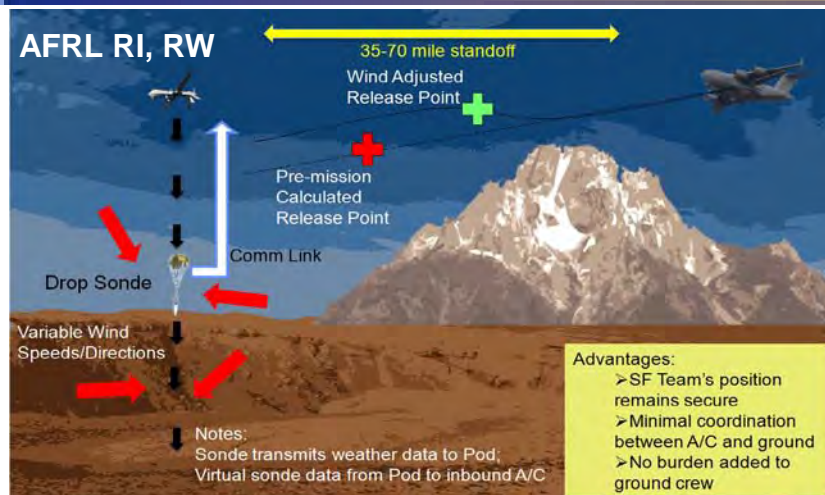
- **“Precision” was the original intent of the AFRL Air Drop focus**
- **AMC’s desire was for AFRL to address urgent needs with:**
 - **Critical resupply**
 - **Humanitarian airdrop**
- **AMC’s urgent needs shaped the definition of precision**
- **The AFRL Air Drop scope addresses precision as:**
 - **Single pass**
 - **Dispersion predictability**
 - **Situational awareness of bundles**
 - **Impact point accuracy**



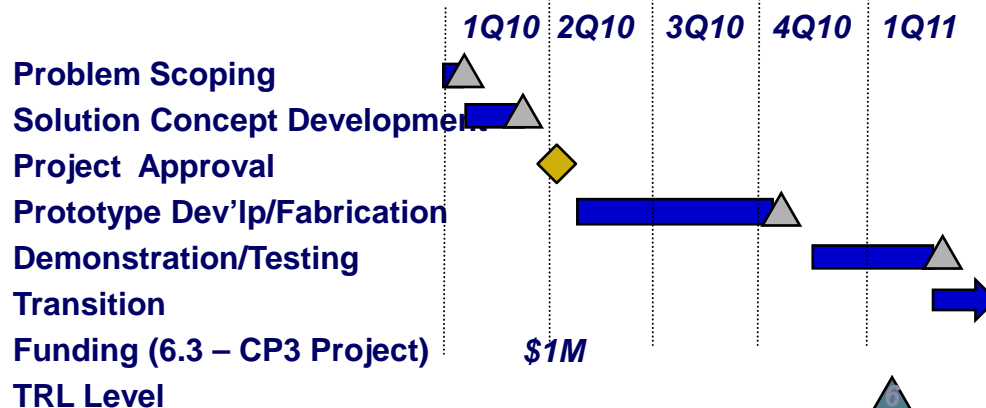
SINGLE PASS AIR DROP & PRECISION AIR DROP



Single Pass Airdrop (SPAiD)



Technology Investment Schedule (FY10)



Description

Rapidly find technical solution for AFCENT UON to eliminate need for 2 passes over drop zones during high altitude airdrop ops

Technology

- AFRL proposed UAV-based weather drop sonde-release solution; Ready to demo in 2Q11
- Integrate into C-17, C-130 Joint Precision Air Drop System Mission Planning (JPADS-MP) Computer

Benefits to the War Fighter

- Eliminates multiple aircraft passes over drop zone
 - Reduces potential for enemy fire
 - Prevents tip-off of drop event
- Allows precision delivery of packages with lower-cost Improved Container Delivery System (ICDS)
- Simplifies mission profiles and time aloft for air delivery missions
- Solves AFCENT UON/Requirement



Single Pass Air Drop (SPAiD)

FY10 Accomplishments



- **Objective:** Collect current, drop zone (DZ) weather data, which will enable mobility aircraft to perform accurate air drop to the target DZ in a *single pass*

- **Challenges**

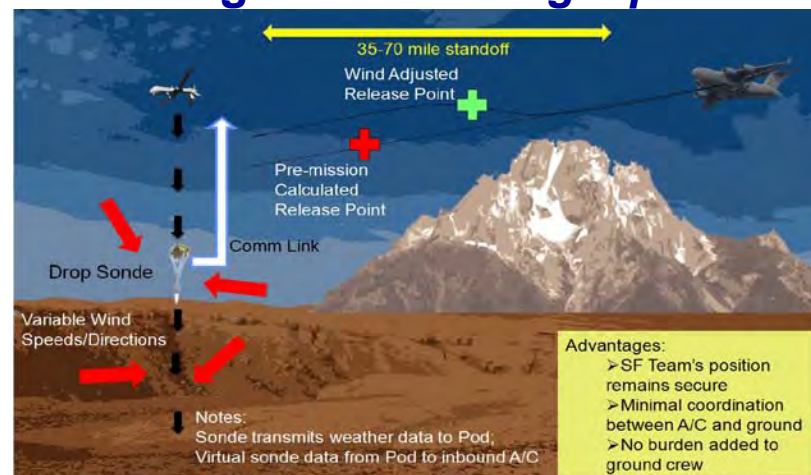
- Coordination Efforts

- AMC/ AFMC/ ACC/ AFCENT
 - In-theater

- Reduce drop sonde size; increase reception range
 - Pod attachment to RPA (Predator)
 - Pod design/flight worthiness approval
 - Surrogate flight approval/Pod components flight test
 - UON priority--compressed schedule
 - RPA (Predator) asset availability
 - We need a Predator for 1-week test in CONUS

- **Accomplishments**

- Smaller drop sonde – 87% reduction in weight
 - Predator availability in-theater; support from 62 ERS (Kandahar)
 - Data Storage/Forwarding
 - increased reception from 6nm to 100nm
 - Pod slide-on attachment to Hellfire rail system
 - Successful Pod components flight test, Dec 2010
 - AMC/AFCENT G.O. level coordination and endorsement
 - Transition to part of FCC from CP-3



M34 Dummy Hellfire Interim pod

- ~99 lbs
- Quick Seek Eagle Approval



- **Lightweight TMS pod**
 - ~15 lbs
 - Transition 3Q11



Precision Airdrop



Description

Develop technologies that improve the accuracy and lowers the cost of Container Delivery System (CDS), humanitarian, and guided airdrops.

Technology Challenges

- Real-time wind sensing
- Automated green light release technology integration
- Error budget analyses and improved modeling approaches
- Low cost highly accurate guided drop systems
- Humanitarian relief delivery concepts

Benefits to Warfighter

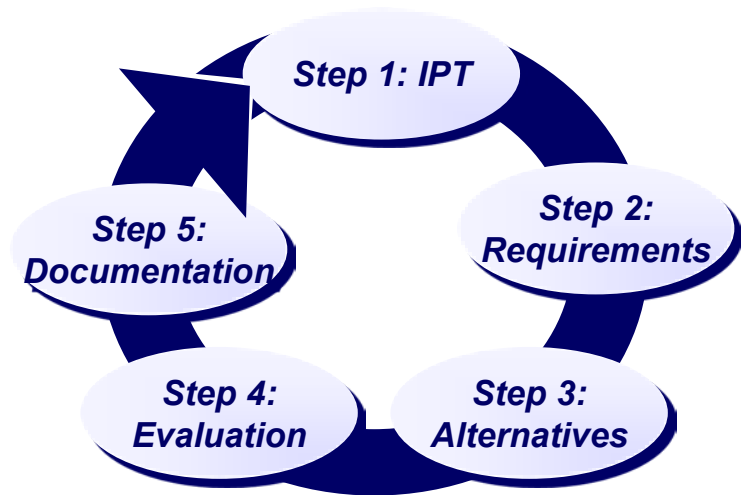
- Improves accuracy of CDS drops
- Lowers the cost of precision drops
- Lowers the risk of unintended consequences
- Improves pre/post drop SA
- Improves bundle SA



AFRL REQUIREMENTS DERIVATION



Systems Engineering (SE) Process

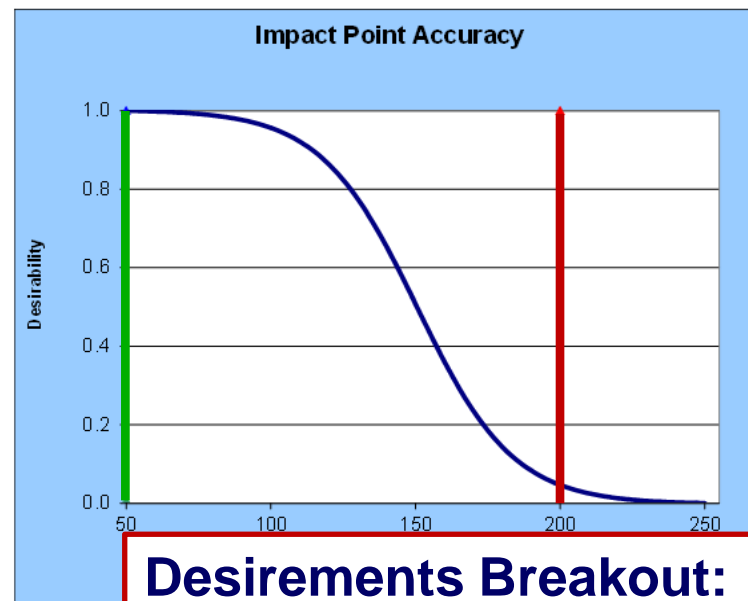


- **Develop Requirements and Metrics**
 - Solicit Input from All Stakeholders
 - Define Measurands, Desirability Functions, and Relative Importance
 - Repeat as Knowledge Advances
- **Generate Technology Alternatives and Conceptual Designs**
- **Perform Value Analysis to Evaluate Alternatives**
 - Evaluate Alternatives against Requirements
 - Compute Desirability and Risk for Each Concept
 - Explore Trade Space
 - Generate or Refine Alternative Approaches
 - Select Most Promising Approach
- **Deliver Results: Recommend Alternatives**



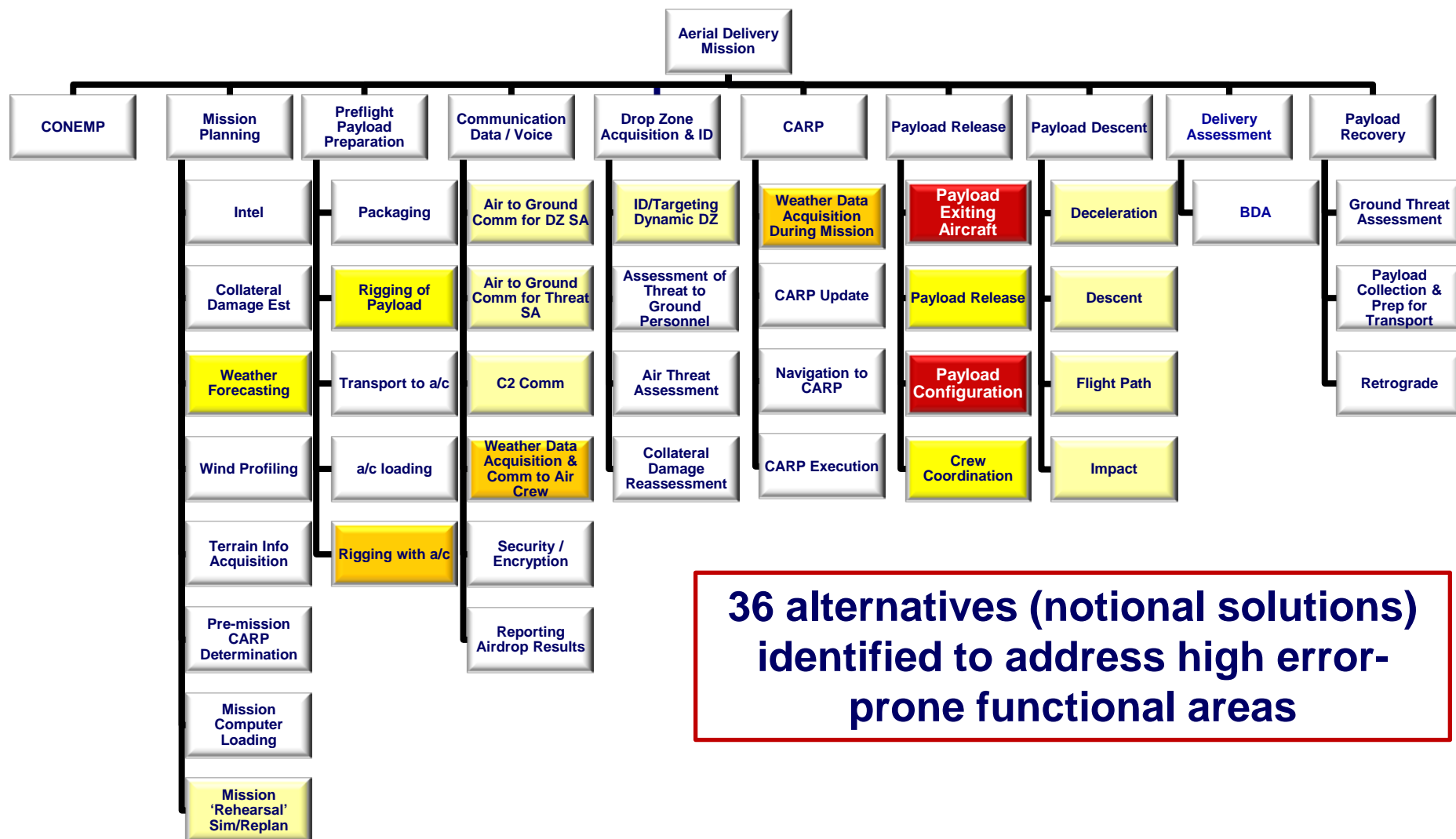
Desirements Development

Des #	Desirement Name	Units	Obj	Risk Limit	Desirement Description	Assumption, How Tested or Other Clarification	Objective Rationale	Rationale for d-Limit	Priority	Wt
Category: A. Performance										
P01	Impact				P01: Impact Point Accuracy Critical Resupply					5
P02	Predict Disper				Description: Accuracy of impact point, measured as the difference between planned and actual (x,y,z) location of center of the dispersion pattern on impact, based on a 3,000 ft AGL drop.					5
P03	Accura Execut				Clarification: This is not a CEP number; it is more a 90% probability number. The expectation for greater accuracy increases at lower altitude.					5
P04	Predict Event				Unit of Measure: meters Priority: Very High Weight: 5 Objective: 50 Risk Limit: 200					5
P05	Platform				Objective Rationale: 50 m 90% of the time is the objective requirement from the JPADS CDD. Risk Limit Rationale: Current level of performance. Must improve upon this.					5
						compatible with aircraft variant; 1 = aircraft				





Functional Work Breakdown Structure



36 alternatives (notional solutions) identified to address high error-prone functional areas



Alternatives Analysis & Tradeoffs

Tradespace Refinement



Des #	Desirement Name	Units	Current		I-Skid		I-SkidAdv		I-Dun		I-DunAdv		I-Release		Active Shaping		ForceEx		Air Bags	
ExpectedWor/BsExpectedWor/BsExpectedWor/BsExpectedWor/BsExpectedWor/BsExpectedWor/BsExpectedWor/BsExpectedWor/BsExpectedWor/BsExpectedWor/Bs																				
Category: A. Performance																				
P01	Impact Point Accuracy	meters	400	800	325	725	300	675	400	800	400	800	250	650	175	575	175	575	400	800
P02	Predictability of Dispersion Pattern	meters	200	400	162.5	362.5	150	337.5	200	400	200	400	125	325	87.5	287.5	87.5	287.5	200	400
P03	Accuracy of CARP Execution	yards	100	200	100	200	100	200	100	200	100	200	100	200	100	200	100	200	100	200
P04	Predictability in the Event of Malfunction	Confidence	90		36 alternatives were given a sanity check and scored against the desirements by time frame...0-5 yrs and 5+yrs												95		90	
P05	Platform Agnostic	Scale: 1-5	1														1		5	
P06	Likelihood of Avoiding Collateral Damage	Probability	90														95		90	
P07	Communication Capability	Scale: 1-5	2	1													2	1	2	1
P08	Agility / Flexibility	Minutes	20		20		20		20		20		20		20		20		20	
P09c	Number of Passes	Count	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2
P09h	Load Deliverable in a Single Pass	%	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2
P10	Survivability of the Load	Confidence	90		90		90		93		95		90		95		90		97	
P11	Bundle-Awareness Capability	Scale: 1-5	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
P13	Mass Capability (Max)	lb	2200	2200	10000	15000	10000	15000	10000	15000	10000	15000	10000	15000	10000	15000	10000	15000	2200	2200

36 alternatives were given a sanity check and scored against the desirements by time frame...0-5 yrs and 5+yrs



Findings and Way Forward

- The SE process educated AFRL on air drop and the associated trouble spots
- The process became less effective with the scoring of the alternatives against the desirements
 - Lack of real data prevented an understanding of how the alternative would affect the air drop outcome
 - There was no robust error budget model or analyses available
 - Outcome set the stage for a multi-phase AFRL approach
- The AFRL Air Drop way-forward is evolving
- AFRL is proposing a Phase I discovery period where AFRL/Army Natick/AMC work to collect data from air drop flights



Way Forward – cont'd

- **AFRL has teams addressing:**
 - On-board WX sensing integrated with sniper pod technology
 - Automated Green Light Release
 - Payload Exit/Release Improvement
 - Air Drop for Humanitarian Relief
 - Low Cost Guided Air Drop
- **Each team lead has emphasized the need to capture:**
 - Aircraft dynamics at release point
 - Bundle dynamics at release point and during descent
 - Weather situation and affects
 - Parachute specifics (type, material, extraction/opening times)
- **A complete picture of the problem is needed to drive our S&T efforts to the highest payoff solution**



Summary



- **AFRL is fully engaged in the air drop problem**
- **The problem is challenging and needs further deep-dive understanding**
- **AFRL is planning on FYDP solutions that can be transitioned to AMC to address CDS and humanitarian drops**
- **AFRL is also working plans with the Army to make guided air drop systems more attractive**
- **The AFRL S&T process needs to be thorough to yield high payoff solutions**



USPACOM Science and Technology

Soft Power and its use in the Asia Pacific Region



*Mr. Ken Bruner
Science and Technology Advisor
HQ U. S. Pacific Command*

*Kenneth.bruner@pacom.mil
808-477-0795*

June 2011

How is the US viewed by the international community?





What is “Soft Power”?

Posit a definition:

*** “Soft power is influencing others to act in mutual interest by appealing to shared values”**

Culture, political values, and foreign policies

Compared to “Smart Power” and “Hard Power”

*** Joseph Nye, Dean of Harvard’s Kennedy School of Government**



Which “Power” is Best?

Choosing which power(s) to use depends upon what effect(s) we’re trying to achieve

Soft power is more about winning the peace

Longer-term effects

Moral high ground

Borrowing Brilliance, David Kord Murray

Root cause analysis: “Why is a problem a problem?”

Root problems for warfighting seem to point to higher level problems best addressed by soft power



What Role Does S&T Play in Soft Power?

Most nations value the development and prosperity that scientific and technological advances bring

First, how do we equip our PACOM ambassadors to engage across the theater?

Second, how do we use S&T to initiate and improve broader military-to-military engagement and interoperability with our allies and strategic partners?

There is so much more we can do, and at PACOM we are open to any and all S&T partnership opportunities that we can tie to our most pressing challenges across our strategic and operational portfolios.

Be cautious of unintended effects/consequences

Common Challenges and Mutual Opportunities





Two focus areas for S&T

- **Humanitarian Assistance/Disaster Relief**
 - **Resilient Communities**
 - **Energy (Renewable energy sources)**
 - **Water (Long term, safe water supplies)**
 - **Education (Distance learning, Mobile Learning Environments)**

- **Maritime Security**
 - **Anti-piracy**
 - **Illegal fishing**
 - **Smuggling**



Energy Efficient Water Purification focused on USPACOM HADR

- ID HADR capabilities with respect to small unit and local populace water purification.
- Ten systems assessed in a limited objective experiment as part of Crimson Viper Field Experiment 2010 (CV10) in Sattahip, Thailand.
 - Thai military operators and lab technicians operated the systems and provided subjective feedback
 - Water quality analysis was both subjective (by operators) and objective (lab analysis of samples)



ASPEN WATER 2000DM



**UH SLOW SAND
FILTRATION**



Distance Learning

- **Telemedicine with Mongolia**
- **Discussion of use of distance learning with Indonesia**



Maritime Awareness

Senator John McCain said on Monday,

“the United States should help members of the Association of Southeast Asian Nations to develop and deploy an early warning system and coastal vessels in contested waters”

Tensions between China and other rival claimants to the strategically vital waters -- home to two potentially oil-rich archipelagos, the Paracels and Spratlys -- have escalated in recent weeks.

Source: Energy Daily June 20, 2011



The Philippines and Vietnam in particular have expressed alarm at what they say are increasingly aggressive actions by China in the disputed waters



Technology for affordable Maritime Awareness

Low Cost Dual Use HF OTH Radar



Commercial RADARSAT



Small, low-cost Autonomous UAS

Heavy Fuel
Beyond Line of Sight
Loiter 33 hours
Power 2.1 kw
Range > 2000nm
Usable payload – 76 pounds
ITAR being worked
Payloads

- AIS
- FMV EO/IR
- SAR
- SATCOM



Common Challenges and Mutual Opportunities





“Tell him we haven't got time for any of his bright ideas – we've got a battle on our hands”



Science and Technology Development

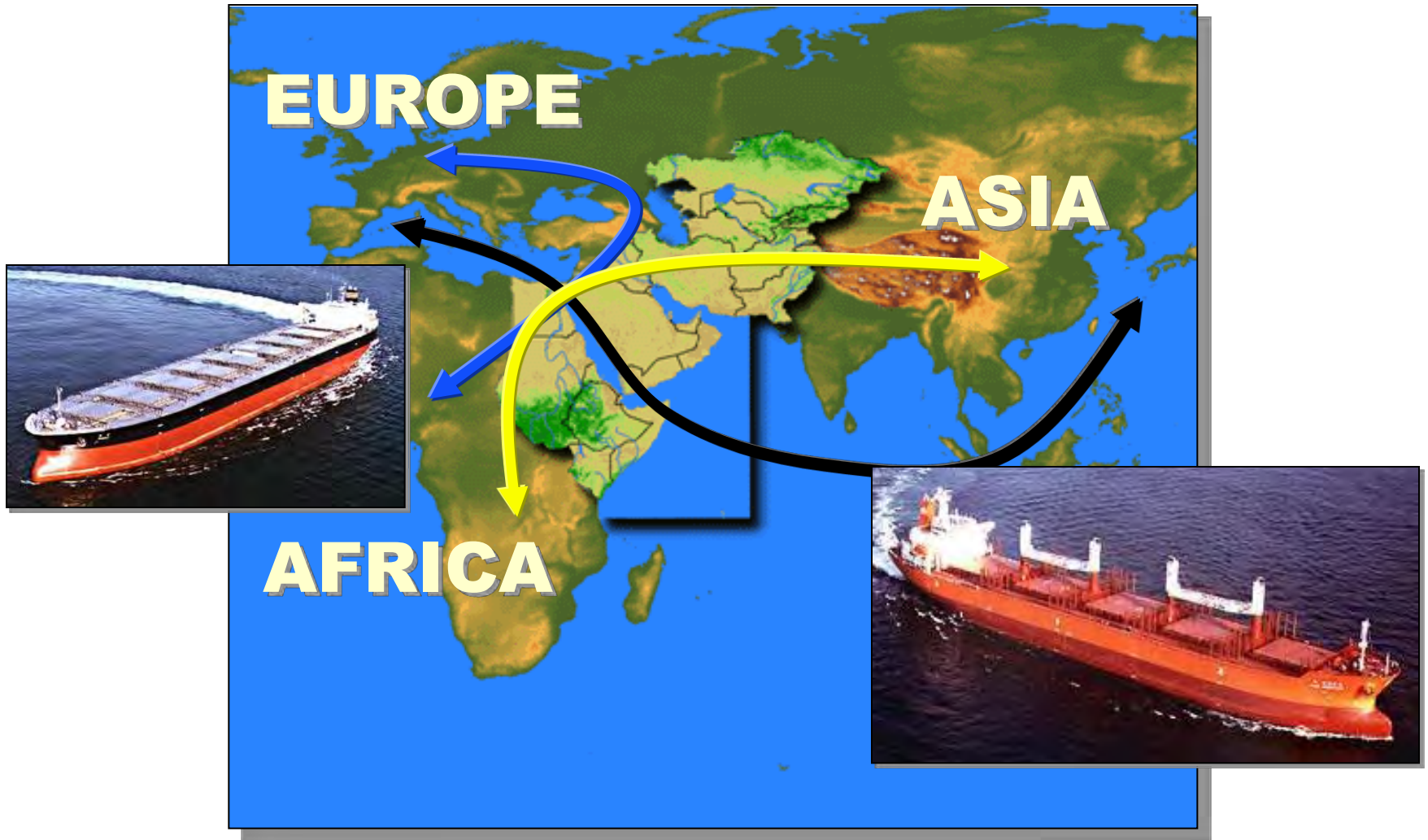
From the Combatant Command Perspective

Where we fit in with the rest of the COCOMs



Central Region

Crossroads of Three Continents



Strategic Interests & Mission

- **Security of the U.S. citizens & the U.S. Homeland**
- **Regional stability**
- **International access to strategic resources, critical infrastructure, & global markets**
- **Promotion of human rights, rule of law, responsible & effective governance, & broad-based economic growth & opportunity**

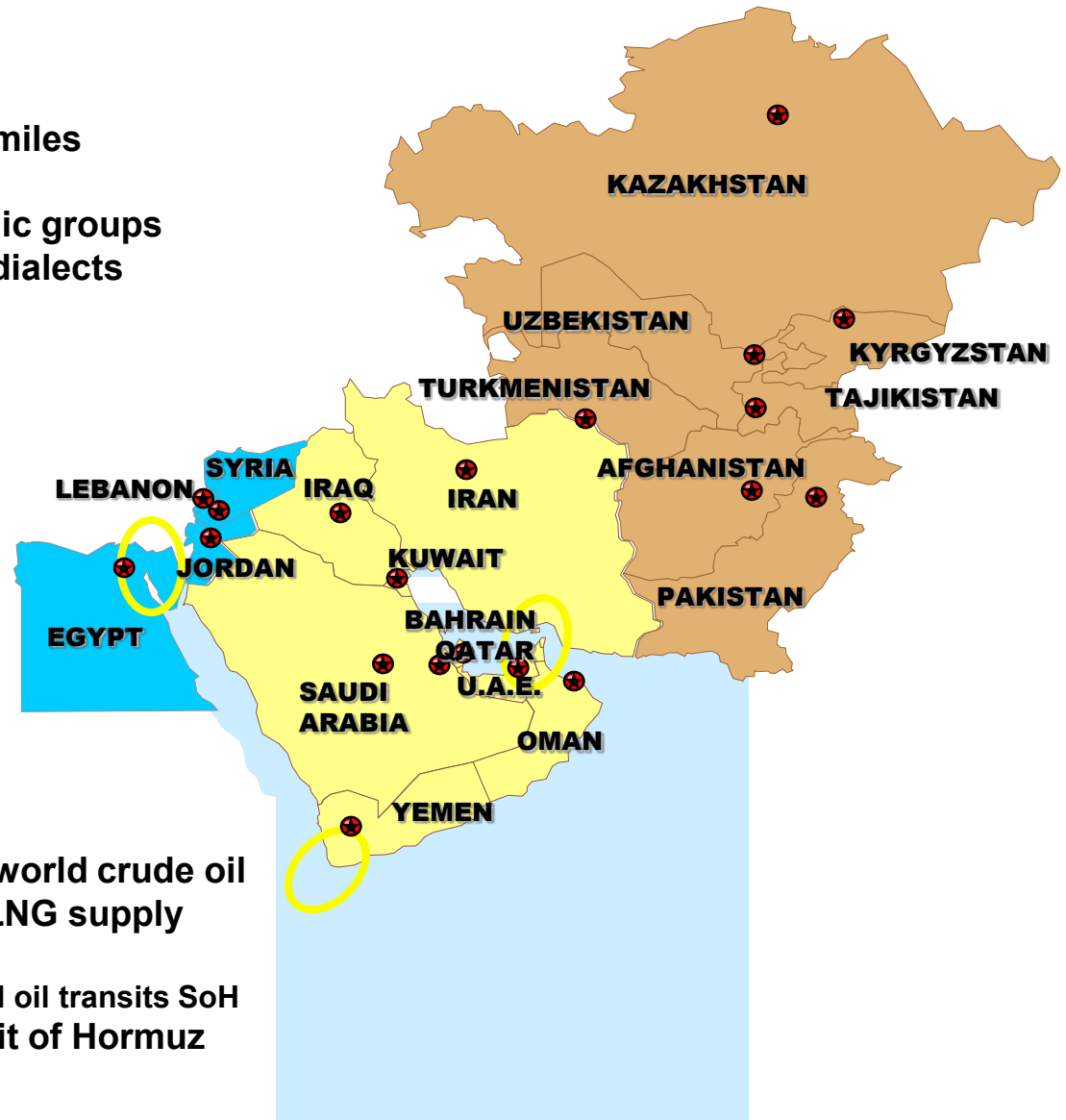
With our national & international partners CENTCOM will:

- **Promote security & cooperation among nations**
- **Respond to crisis**
- **Deter & defeat state and non-state aggression**
- **Support development & reconstruction to establish conditions for regional security, stability, & prosperity**

CENTCOM - Area of Responsibility

Complex

- 20 Countries, 4.5 million square miles
- 1.1 Million square miles of ocean
- 531 Million people, 16 major ethnic groups
- 7 Major languages, hundreds of dialects
- 4 Major religions



Global Economic Impact

- Arabian Gulf produces ~ 31% of world crude oil
- Region exports ~ 26% of global LNG supply
- 3 x Strategic Choke Points
 - Appx 40% internationally traded oil transits SoH
 - 21% of LNG goes through Strait of Hormuz

Vision – We seek a region:

- **At peace with itself & its neighbors**
- **Focused on common security & cooperation**
- **With stable governments responsive to the needs of the people**
- **With economic development that advances the population's well being**
- **Free of nuclear weapons & where nuclear energy use is verifiable & for peaceful purposes**
- **With unhindered international access to strategic resources, critical infrastructure, & global markets**
- **Which does not allow the safe haven of extremists which threaten Americans or our friends & allies**

Challenges

- **Lack of progress in the Middle East Peace Process**
- **Extremist ideological movements & militant groups**
- **Proliferation of WMD**
- **Ungoverned, poorly governed, & alternatively governed spaces**
- **Terrorist & insurgent financing & facilitation**
- **Piracy**
- **Ethnic, tribal, & sectarian rivalries**
- **Disputed territories & access to vital resources**
- **Criminal activities: weapons smuggling, narcotics, human trafficking**
- **Uneven economic & employment opportunities**
- **Lack of regional & global economic integration**

Priority Tasks for CENTCOM

- **Reversing the momentum of the insurgency in Afghanistan**
 - **Regain the initiative**
 - **Restore public confidence in the GoA**
- **Maintain kinetic / non-kinetic pressure against threats to National security and our Allies**
- **Expand our partnership with Pakistan**
 - **Support their operations against militants**
 - **Assist in developing their counterinsurgency capability**
- **Counter malign Iranian activities & policies**
- **Counter proliferation of WMD & build partner capacity to prevent and/or respond to WMD events**
- **Bolster military & security capability of our regional partners**
- **With our partners counter piracy, illegal narcotics, & arms smuggling**
- **Ensure responsible expenditure of funds**
- **Reduce strain on the force & the cost of our operations**

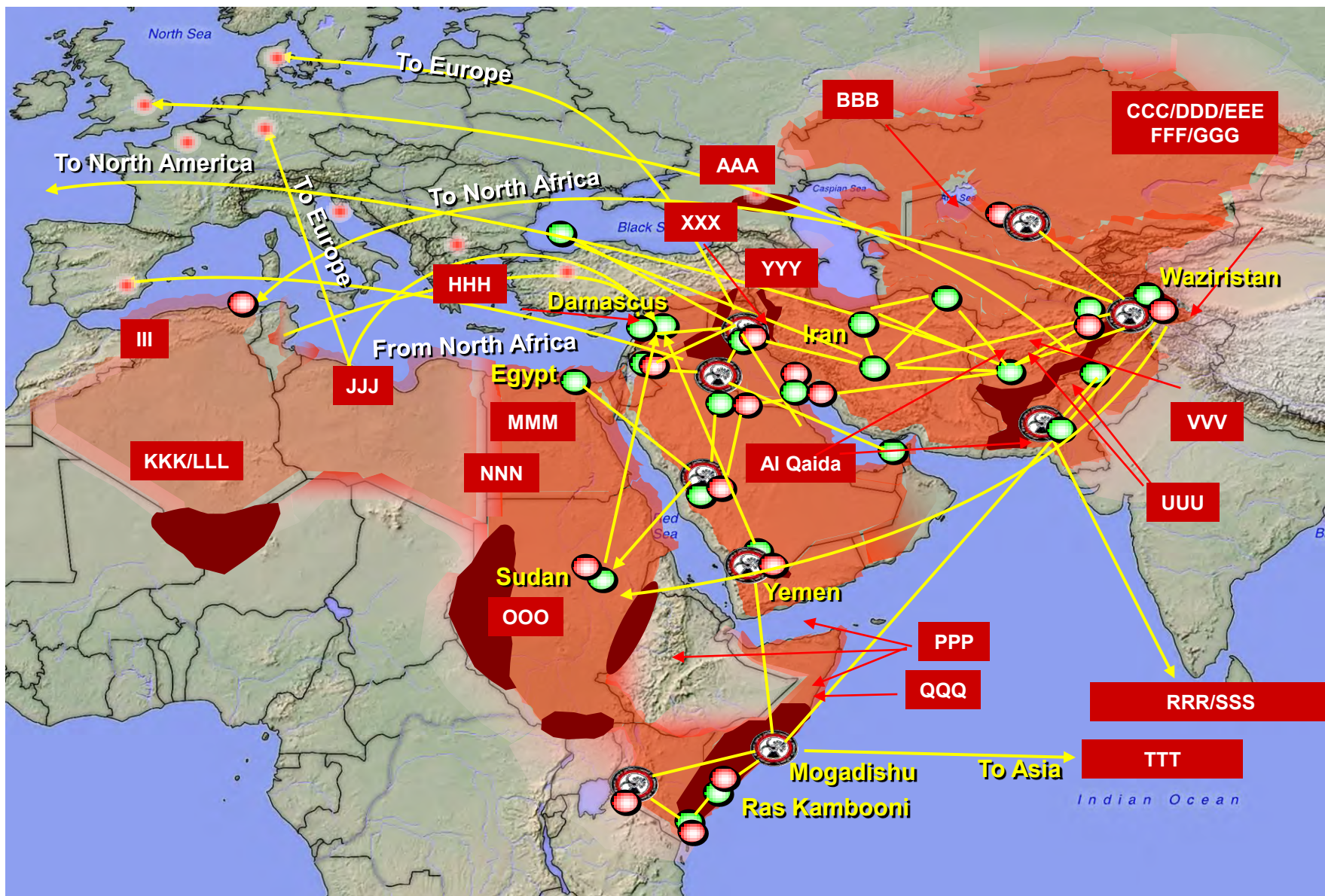
Major Activities

- **Defeat al-Qaeda & associated movements**
- **Deny sanctuary & support for violent extremist groups**
- **Counter proliferation of WMD & associated technologies**
- **Deter & counter state-based aggression & proxy activities**
- **Support peaceful resolution to long-standing conflicts**
- **Build bi-/multi-lateral partnerships**
- **Develop partner nation capacity**
- **Assist nations in their ability to protect their critical infrastructure & support robust infrastructure development**
- **Bolster at-risk states**
- **Respond to humanitarian crisis**
- **Counter arms smuggling**
- **Protect freedom of navigation**

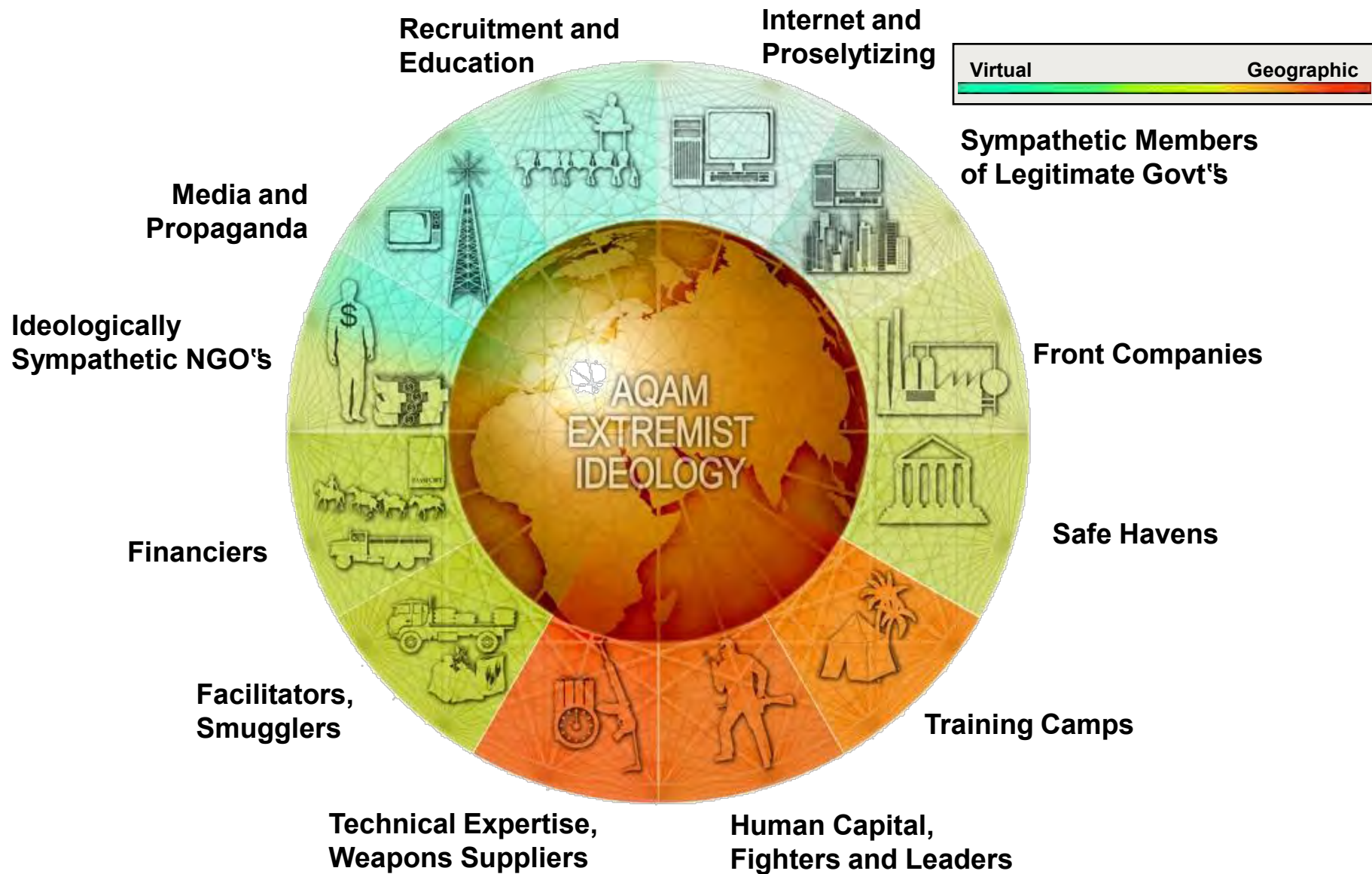
The Nature of the Enemy

- A network guided by ideology
- Amorphous worldwide network which operates as a web of cells
- Fueled by militant Islamic zeal
- Anti-Zionist
- No state boundaries
- Powerful virtual element
- “Virtual Caliphate” - All directed toward the eventual establishment of a pan-Islamic state - the “Physical Caliphate”
- Seek safe-havens, physical footholds for recruitment, training, financing, and propaganda initiatives which complement its virtual element
- Well financed and has a simplified acquisition/training/fielding strategy

Al Qa"da and Associated Movements (AQAM)



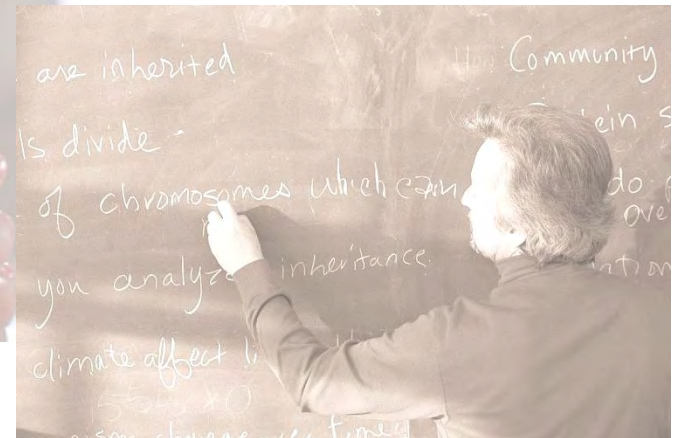
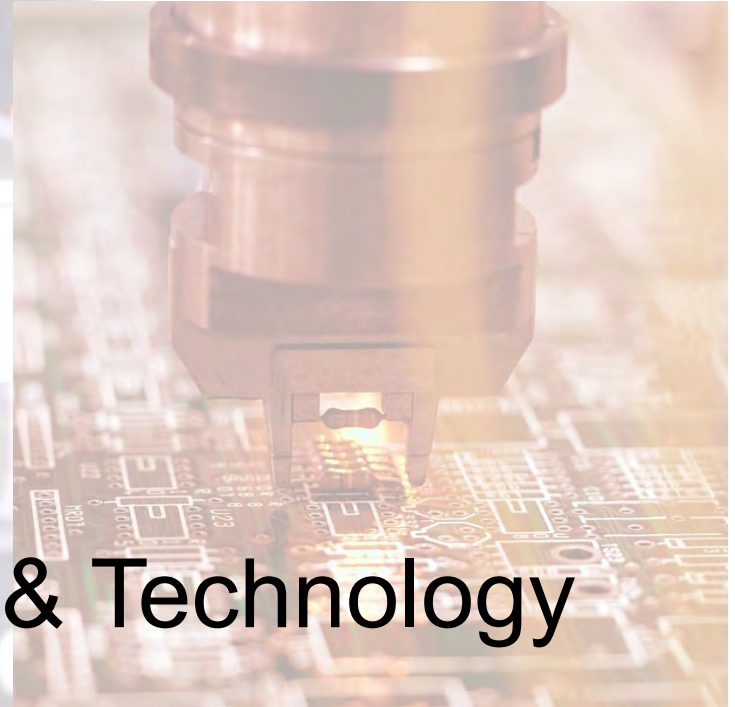
AQAM: A Threat in All Realms



It Takes a Network ... To Defeat a Network



The Role of Science & Technology



Charter

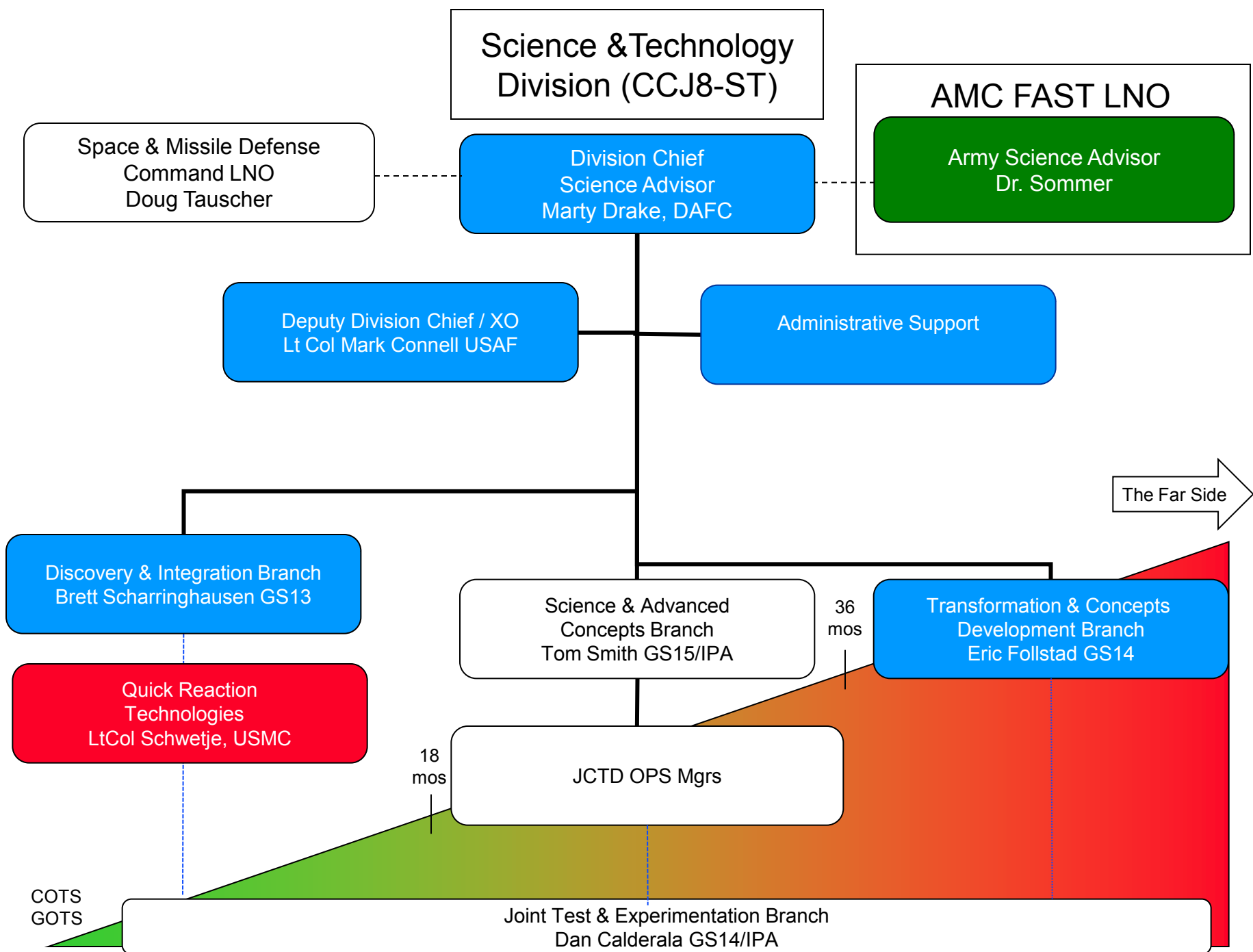
Conduct ***discovery, research, analysis***, and ***sponsor development*** of new and emerging technologies which have the ***potential to provide material solutions*** to Headquarters and Component validated Joint needs.

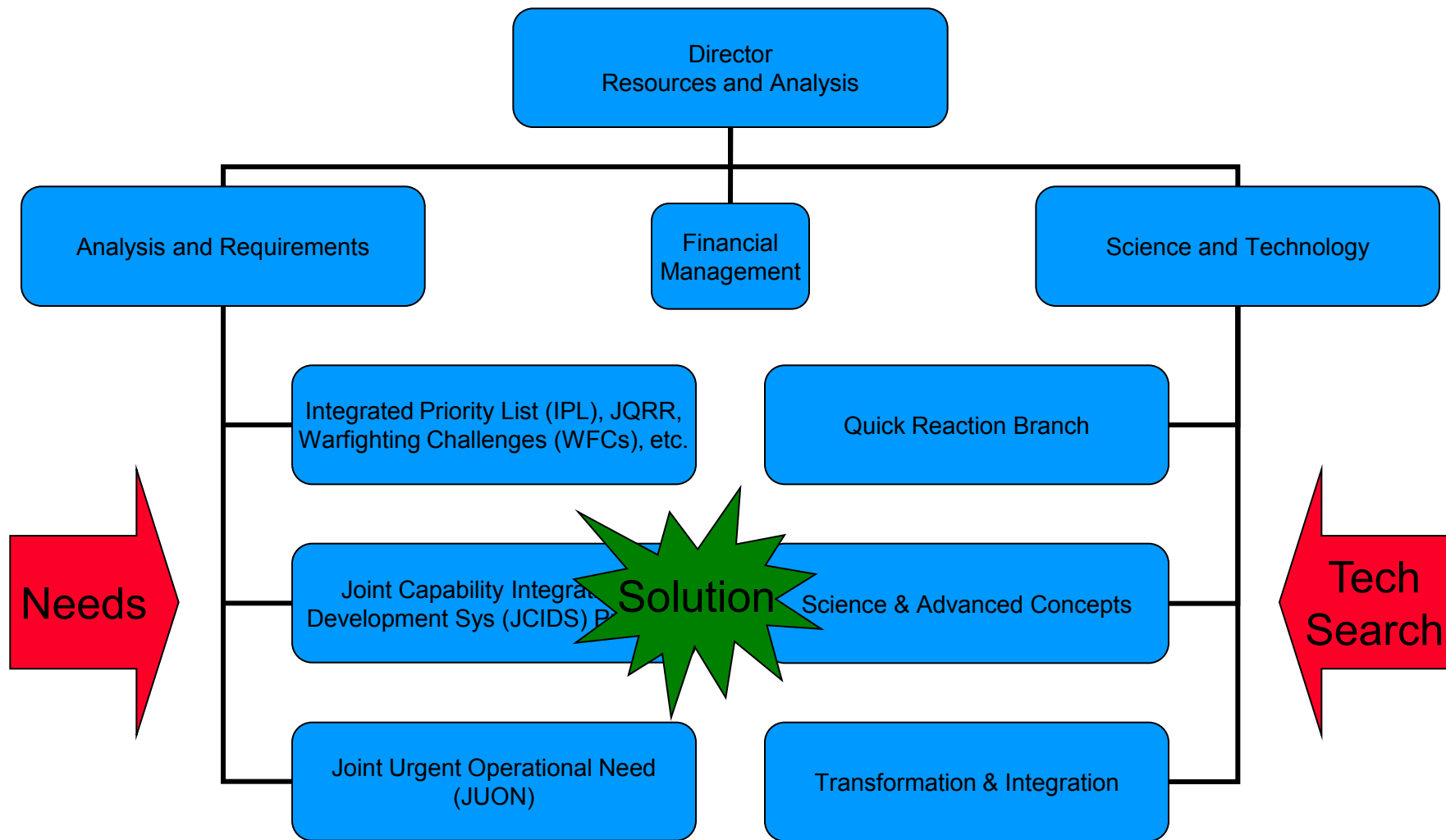
Review USCENTCOM and Component ***plans, operations***, programs, policies and activities for areas where technology will improve efficiency and effectiveness.

Integrate across USCENTCOM headquarters and Component staffs for transformational, integrating, and experimentation activities.

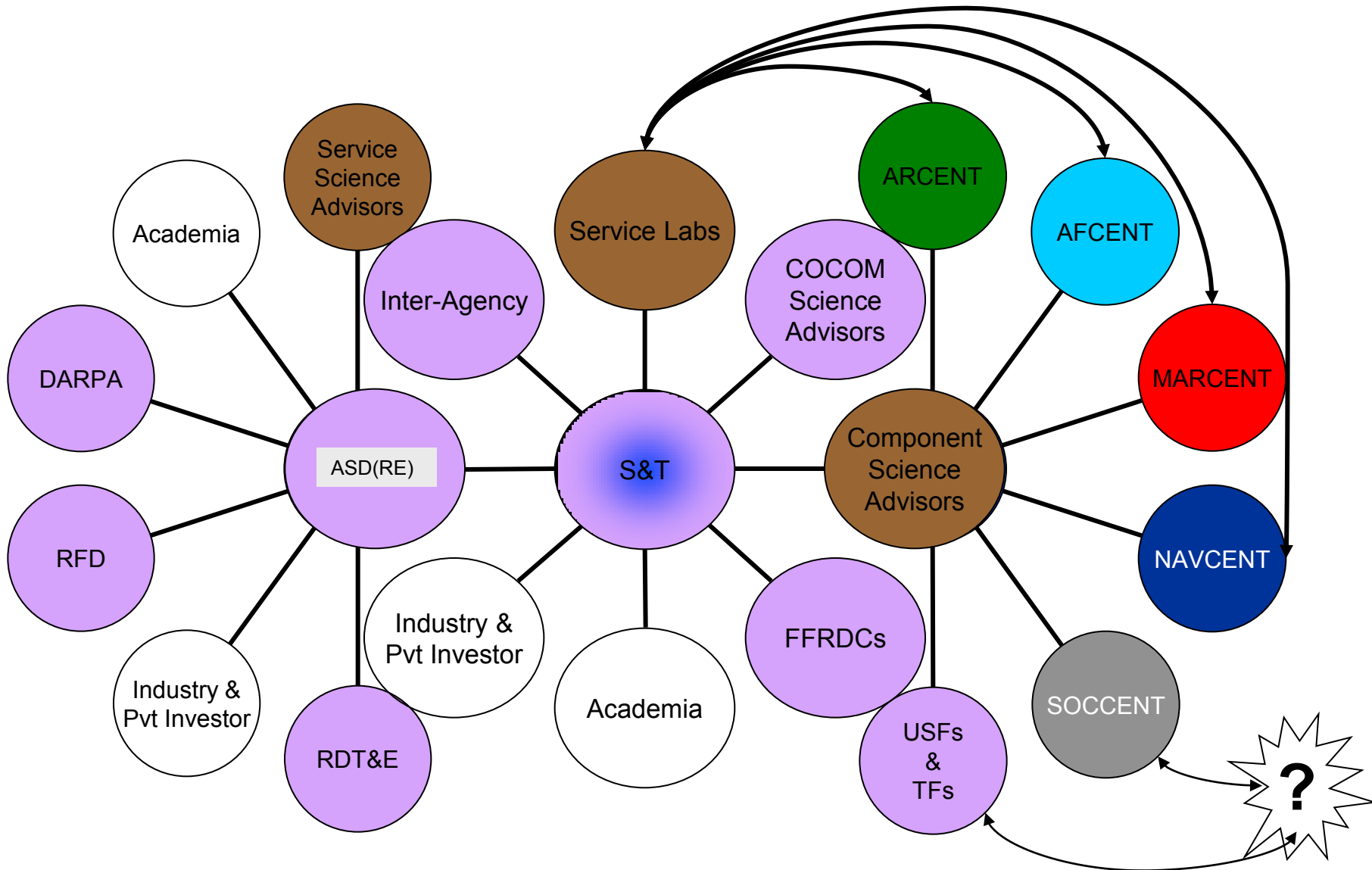
What we do

- **Technology discovery, research & analysis, and inform the staff & OSD on promising initiatives**
 - **Attend technology symposiums / reviews**
 - **Service Labs, DARPA, FFRDCs**
 - **Private industry & Academia**
 - **Conduct global market research**
 - **Provide initial feasibility / technical merit on proposals**
- **Needs pull**
 - **Conduct HQ USCENTCOM Leadership, Directorate, & Component outreach**
 - **Participate in planning, operations, & exercises**
 - **Review submissions from the requirements generation processes for technology needs to support the Warfighter**
- **Operationally Manage technologies we sponsor**
- **Participate in limited objective experiments**





How we connect



U.S. Central Command Tech Focus

- We focus on the **JOINT** solution that has the potential to satisfy a **JOINT validated** need
- Separate from the many technology needs of our customer(s) those technology challenges which:
 - *Do not have a readily available solution*
 - For high-impact needs there is *insufficient activity pursuing a solution*
- Seek out game-changing technologies which our customer(s) don't know they need

Some technology areas we “pursue”:

- **Detection of CBRNE at tactically significant distances; with emphasis on the “E”**
- **Pre-shot counter-sniper, counter-mortar, counter-RPG technologies; with emphasis on automated systems**
- **Technologies which enable the transfer of information more securely, more quickly, to a wider set of users, to include the warfighter when it makes sense, with less bandwidth and dedicated support resources, e.g.:**
 - **Multi-level Security over single architectures**
 - **Bandwidth compression / reduction techniques**
 - **Data reduction [data=>info=>knowledge=>understanding=>wisdom]**
- **Through automation, remote action, new and novel techniques, technologies which reduce risk and / or stress on the force and / or improve the efficiency and effectiveness of our action(s)**
- **Technologies which allow for greater persistence over the battlespace with fewer platforms; employing improved sensor technology providing greater fidelity of information**

Common thematic areas of concern

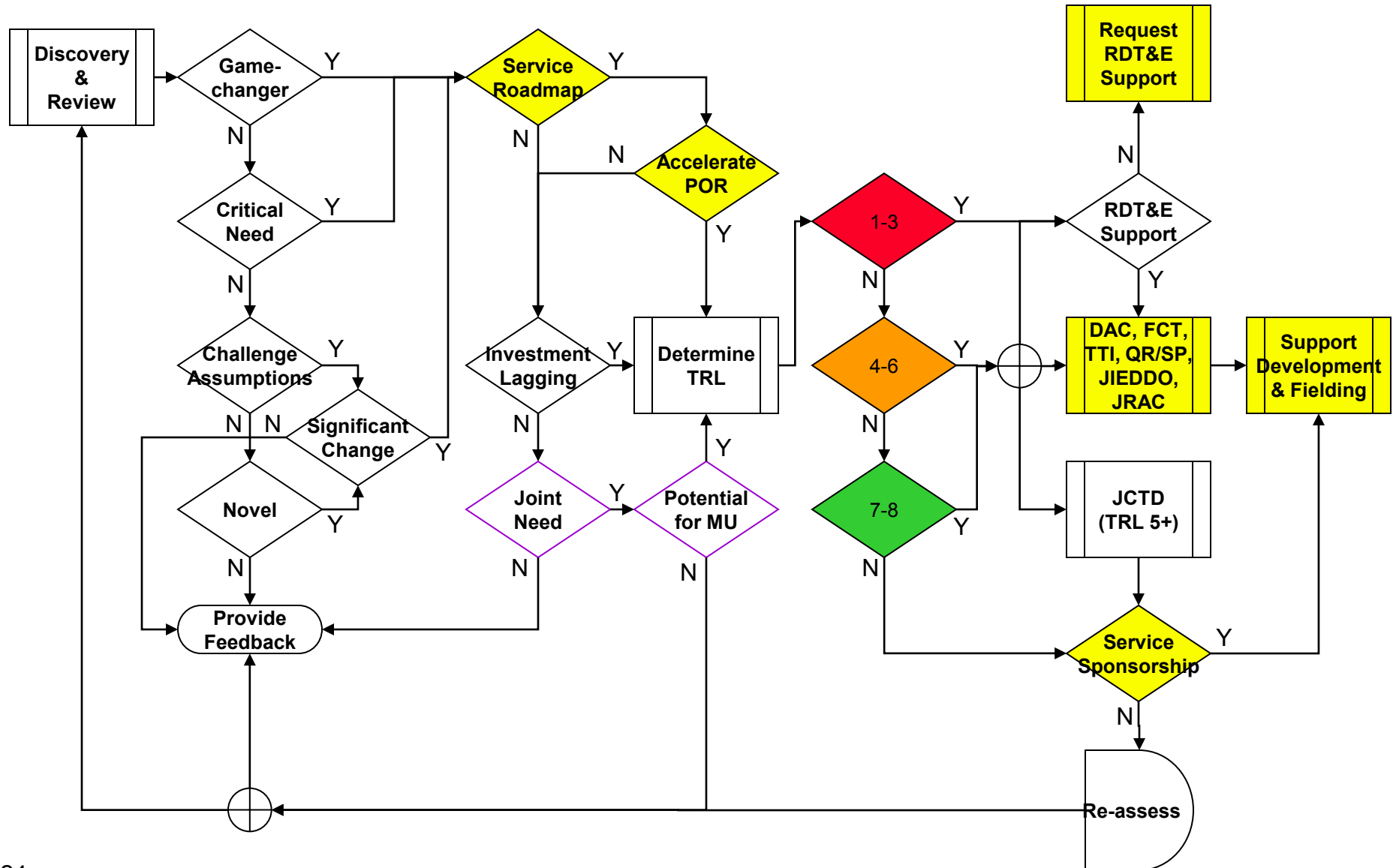
(not in priority order)

- **Detect / Defeat:**
 - IED initiators / initiator systems
 - Buried / concealed IEDs
 - Production and assembly of IEDs
- **HME production standoff detection**
- **Culvert access denial / alerting**
- **Persistence in surveillance**
- **Biometrics**
 - Identity dominance
 - Force protection / access
- **Non-lethal vehicle / vessel stop**
- **Reduce stress on the force:**
 - Force Protection requirements
 - Increased automation
- **Anti-swarm lethal / non-lethal**
- **More efficient / effective / timely trng**
- **Predictive analysis techniques**
- **Voice to text technologies**
- **C4ISR systems:**
 - Info sharing between system
 - Multi-level security
 - Cross domain solutions
 - Faster ... Better sorting / retrieval
 - On the move w/ GIG access to tactical edge
 - SATCOM, WiFi, WiMax, etc.
- **Tagging, Tracking, and Locating (TTL)**
- **Lightweight “x” with greater “y”**
- **More power per unit of weight**
- **Scalable effects – non-lethal to lethal**
 - Directed Energy
 - Kinetics
- **True SA for Blue ... Fused Red**
- **Sustaining the force – reduced size, weight, amount, and retrograde**
- **Holding all targets at risk**
- **Any sensor ... any shooter; the Soldier as a sensor; any adversary ... any battlespace ... anytime**

What would the battlespace be like if ...

- **Bandwidth could be made irrelevant**
- **Concealed / buried explosive material could be detected at significant distances**
- **Tagants in dual-use items used to make homemade explosives when combined cause the mixture to inert**
- **Intent could be pre-determined**
- **A two-way certified cross-domain exchange was available**
- **Warfighter equipment drew its power from the environment (day or night); making power storage devices optional**
- **Aural simultaneous two-way translation into any language was available in a miniature form-factor**
- **...**

Technology Review Process



When proposing a solution ... The Heilmeier Questions ... adapted

- **What are you trying to do?**
 - **Articulate your objectives using absolutely no jargon**
- **Who should care?**
- **How is it accomplished today?**
- **What are the limits of the current practice?**
- **What is new in your approach?**
- **Why do you think you will be successful?**
 - **How do you define / measure success?**
 - **What is your strategy to get there?**
- **How long will it take and at what cost?**
- **What are the risks?**
- **What is your risk reduction / mitigation strategy?**
- **What are the payoffs / return on investment?**

For Technology Developers Some Points to Consider

- **Seek to understand how your solution fits in the overall DoD system of systems**
 - **Integrate with legacy systems vice replace them**
 - **Open architectures receive higher interest / support**
- **Consider partnering with others to bring a „greater“ solution to the table - system best-of-breed vice at the component level**
- **Determine your relative impact to a program of record**
 - **Training**
 - **Initial fielding**
 - **Sustainment**
- **Substantiate your position with data**
 - **Testing**
 - **Cost-benefit analysis**

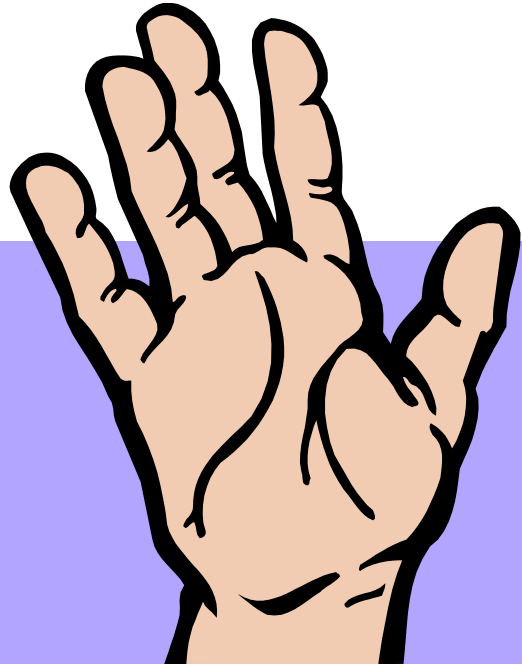
We are Venture Capitalists without any Capital. When a promising technology is discovered, we:

- **Seek OSD / Joint Staff / Service support for funding ***
 - Service programs of record (PORs)
 - Joint Rapid Acquisition Cell (JRAC)
 - Joint IED Defeat Organization (JIEDDO)
 - Quick Reaction Funds (QRF)
 - Rapid Reaction / New Solutions (RR/NS)
 - Force Transformation / Operational Experimentation (FT/OE)
 - Operational Test and Evaluation (Joint Tests & Quick Reaction Tests)
 - JFCOM Limited Acquisition Authority (LAA)
 - Defense Acquisition Challenge (DAC)
 - Technology Transition Initiative (TTI)
 - Foreign Comparative Testing (FCT)
 - Combatant Commander Initiatives Fund (CCIF)
 - Defense Venture Catalyst Initiative (DeVenCI)
- **For those technologies we desire to “sponsor”**
 - Assist the Headquarters and Components in the development of technical proposals to satisfied identified needs
 - Provide oversight management to get the technology into the hands of the Warfighter

* Not an all-inclusive list

Points of Contact

- **Marty Drake** 827-3289 martin.drake@centcom.mil
Division Chief & Command Science Advisor
- **Lt Col Mark Connell, USAF** 827-2494 mark.connell@centcom.mil
Science & Advanced Concepts
- **Brett Scharringhausen** 827-2264 Brett.t.Scharringhausen@centcom.mil
Discovery & Integration
- **Eric Follstad** 827-3341 Eric.A.Follstad@centcom.mil
Transformation & Concept Development
- **Tom Smith** 827-3287 Thomas.Smith@centcom.mil
Science & Advanced Concepts
- **Dr Sommer, DAC** 827-2757 james.sommer@centcom.mil
RDECOM LNO
- **Doug Tauscher** 827-6669 doug.tauscher.ctr@centcom.mil
SMDC LNO



Raise your Hand





Autonomy S&T Priority Steering Council

Team members/Affiliation:

Dr. Bobby Junker

Autonomy PSC Lead

Division Director

ONR/

Presentation to S&T EXCOM

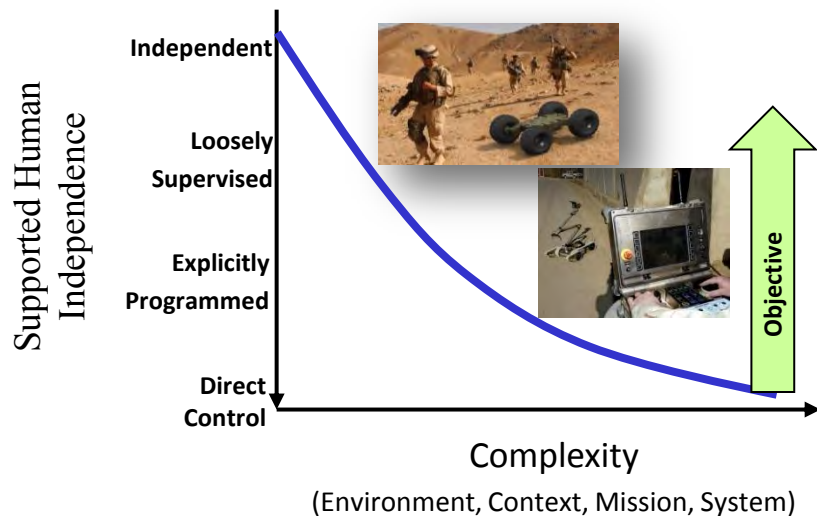
14 June 2011

Team Meetings held:
and frequency

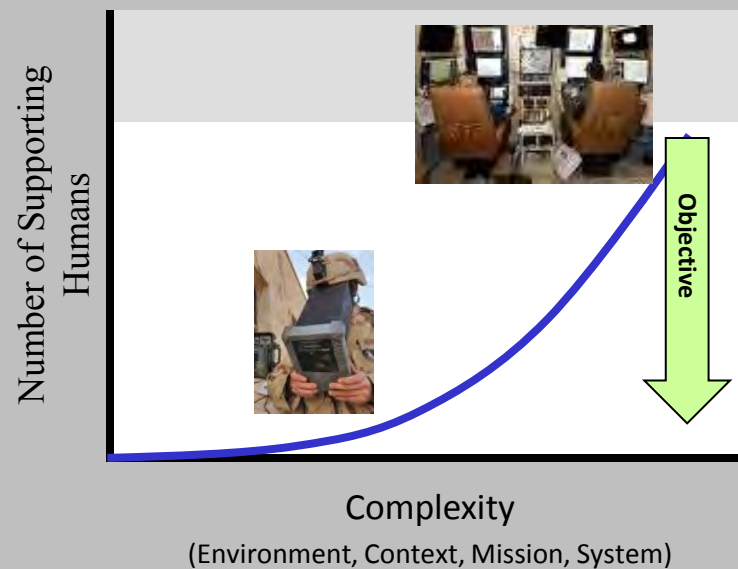


Two Human-Machine Relationships

Human is *Supported*



Human is *Supporting*



Goal

Minimize human control to defining mission

Optimum Level

System understands human intent

Goal

Minimize supporting humans

Optimum Level

Zero

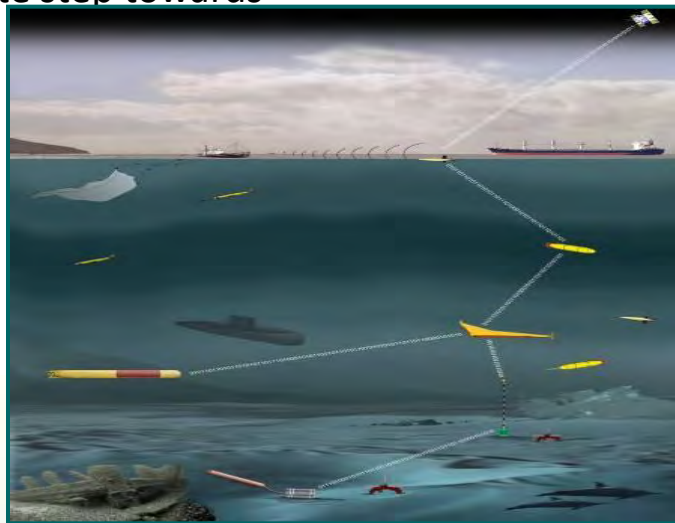


UxV and Autonomy



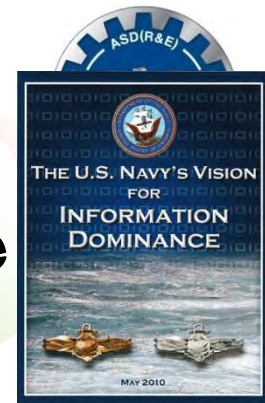
Now:

- Uninhabited UxVs are an intermediate step towards autonomy



We are here

The Future

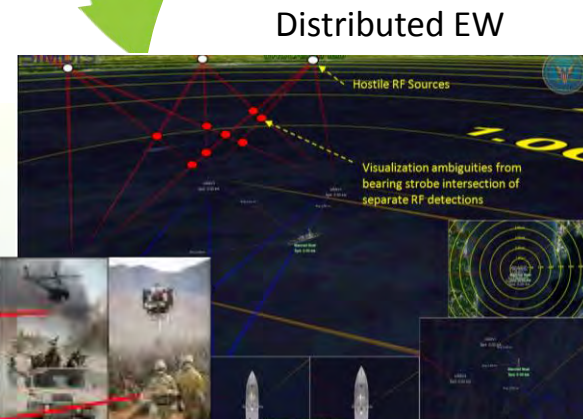


Mid-Term:

- Current UxV systems are rule-based and can support relatively simple missions, but do not operate well in complex, uncertain dynamic environments

Long-Term:

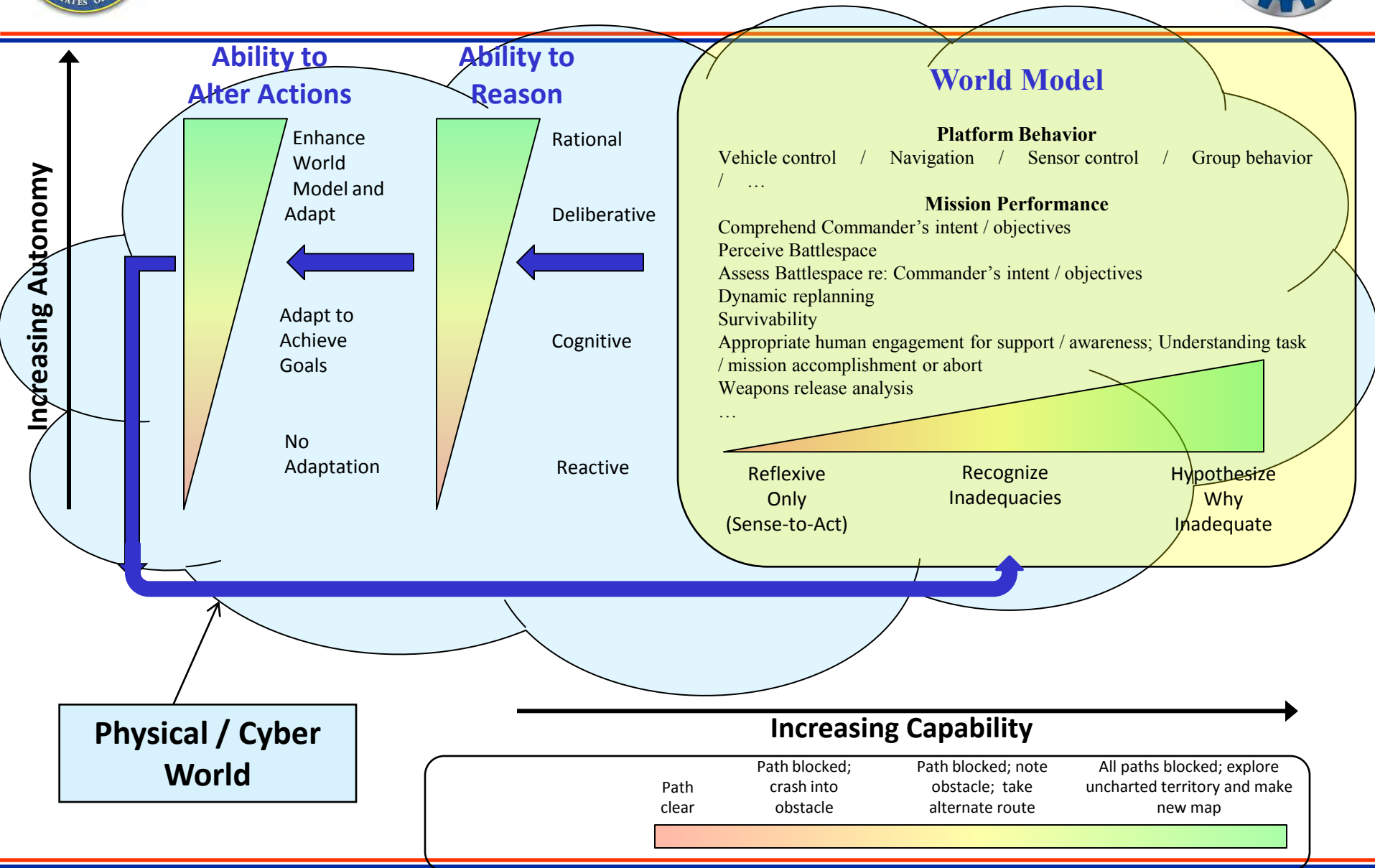
- Level of reasoning capable of comprehending the battlespace
- Automated, coordinated, distributed, adaptive planning



Persistent Littoral Undersea System

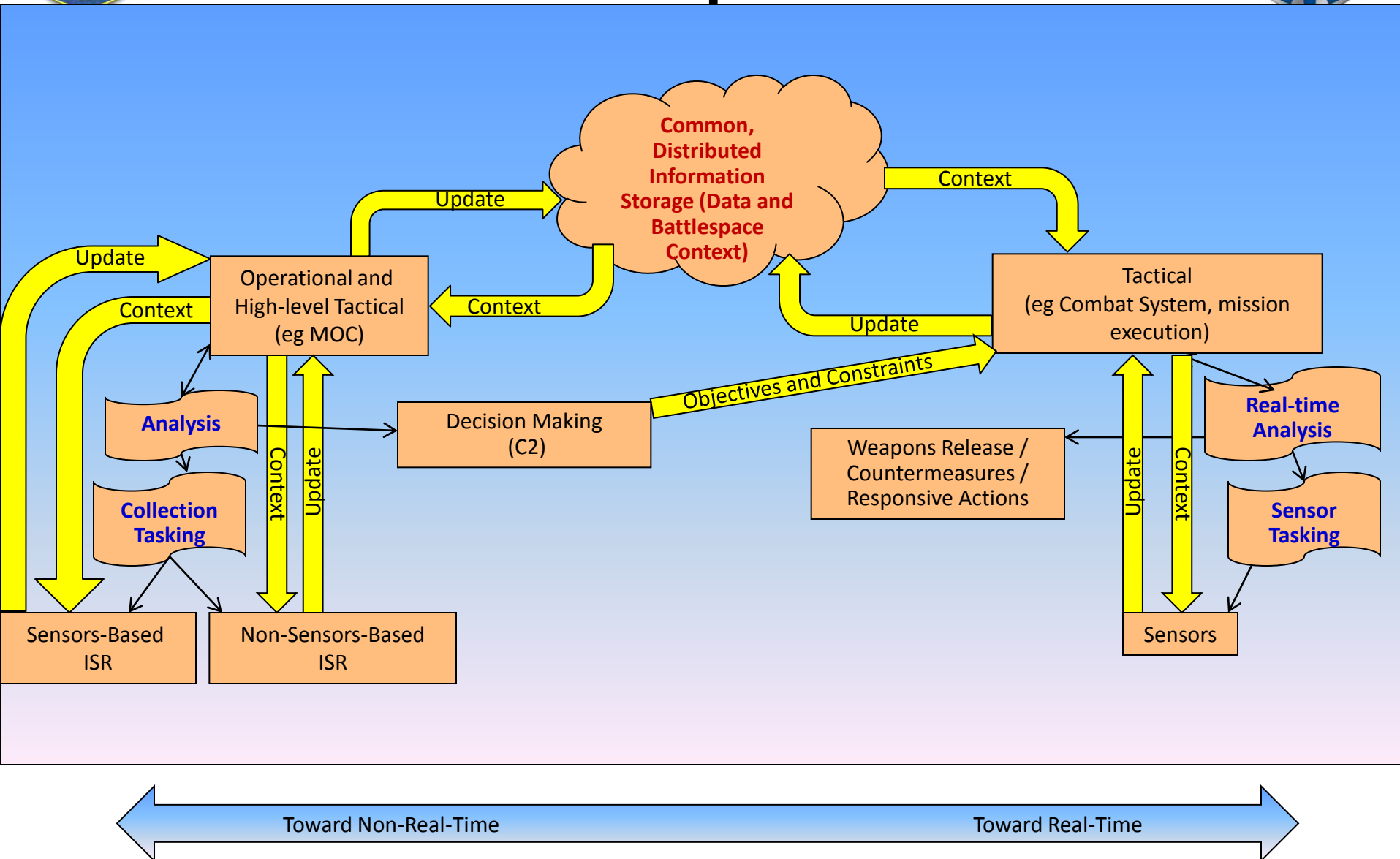


Levels of Autonomy





Operational and Tactical Pictures Development





Autonomy Problem Statements

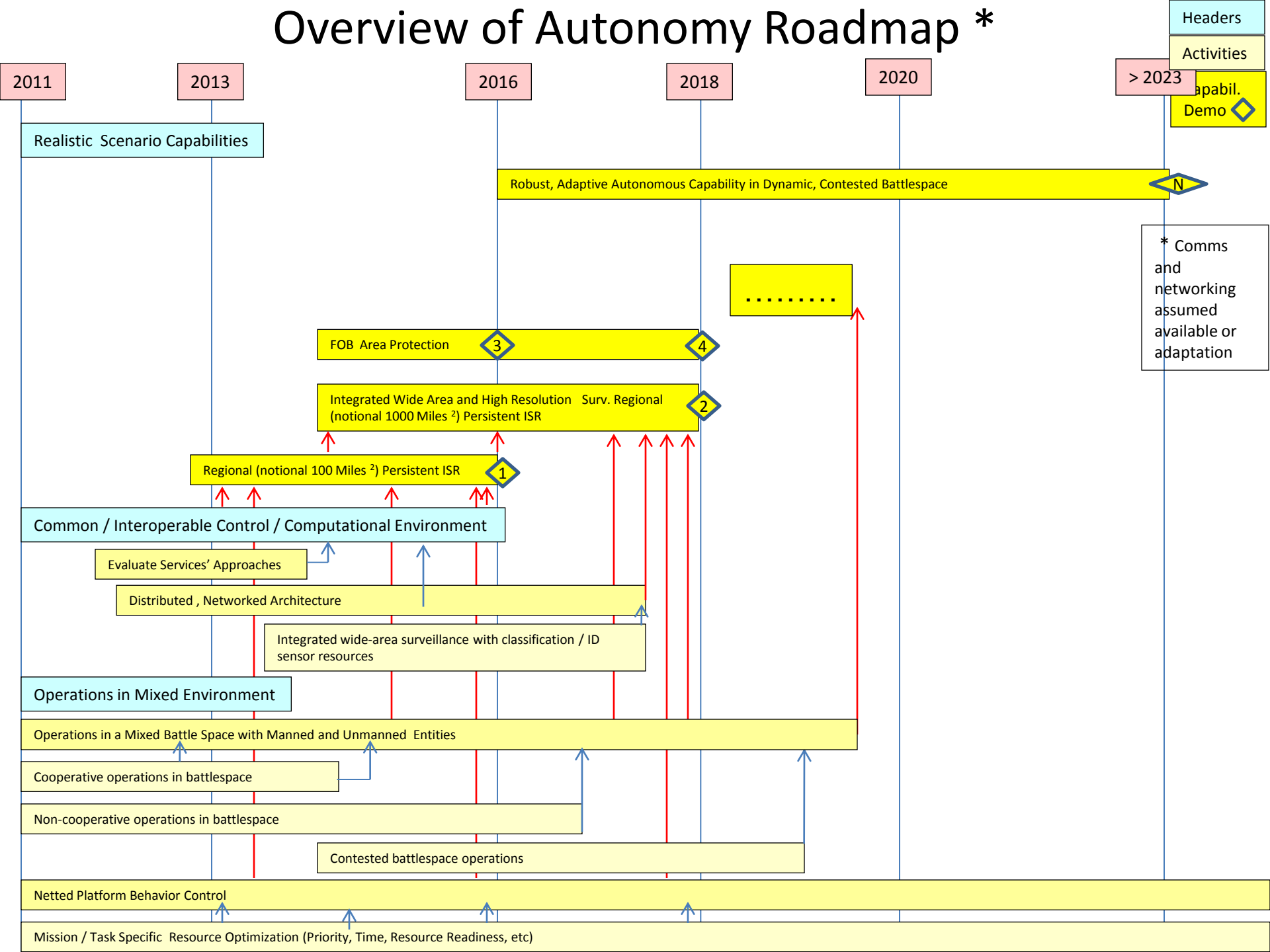
- **Problem: Insufficient manpower to support command and control of persistent, pervasive surveillance assets across relevant battlespace**
 - Desire for, at most, single operator control of unmanned teams
 - Increasing quantity and scope of ISR data pushing analysis “beyond human scale”
 - Expanding domains and time-criticality pushing decision-making “beyond human scale”
- **Problem: Operators/decision-makers don’t have appropriate level of trust in autonomy, ie too low or too high.**
 - Lack technologies for adaptive autonomous control of vehicle systems in the face of extremely harsh, unpredictable and mathematically intractable environments
 - Lack technologies to enable safe manned and unmanned operation in a mixed battlespace (civilian and military AORs)
 - V&V and C&A address only part of trust
 - Ramifications of over-reliance on autonomy in contested, complex battlespaces
- **Problem: Environments so harsh as to not reasonably permit humans to enter and sustain activity**
 - Examples include
 - High radiation, High biological, High chemical environments
 - Mission areas where one may not return



Desired End States

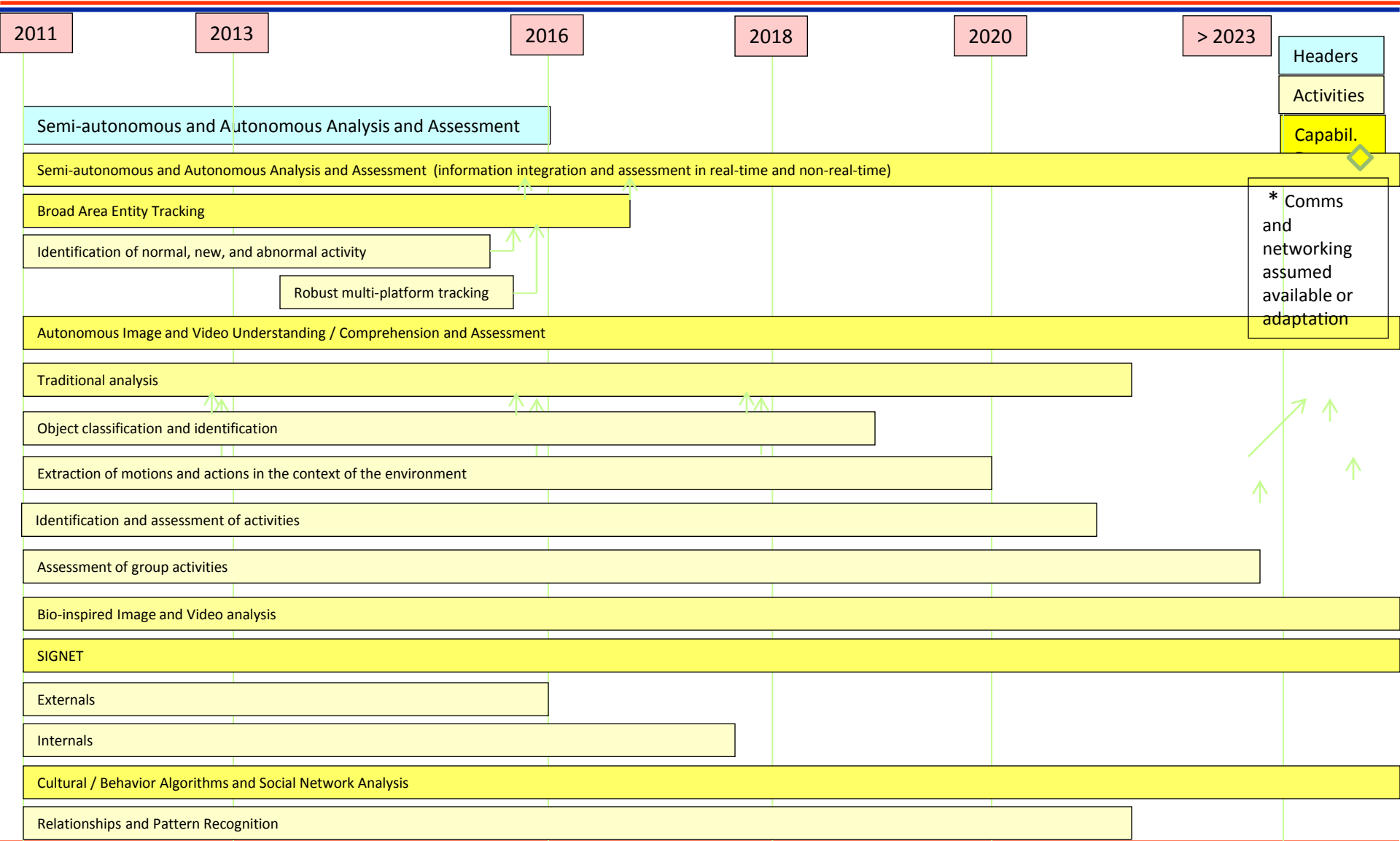
3 year (2016)	5 Year (2018)	7 Year and beyond (2020+)
<ul style="list-style-type: none">• Develop highly flexible, interoperable environment for common control and computations• 50% staff reduction for C2 for a notional 100 sq mile area• Autonomously update battlespace context using available sources• Enable timely operational decision making based on commander's intent• Enable mixed manned/unmanned operations within common battlespace• Complete Phase 1 advanced autonomous tech development<ul style="list-style-type: none">– Tailored pattern recognition– Decision making– Miniaturization of autonomous control sensors, power supplies, etc– Autonomous Protective system defeat	<ul style="list-style-type: none">• No increase in supporting manpower requirements for C2 of 1,000 sq mile area• Integrated wide area – classification / ID sensor resource for autonomous cooperation• Expand mixed manned/unmanned operations to non-cooperative, but not contested battlespace• Enhanced SIGINT input to include signal internals• Continue 2nd generation prototyping• Continue Phase 2 advanced autonomous tech development<ul style="list-style-type: none">– Tailored swarming tech-subterranean– Coordinated multi-unit search– Obstacle negotiation, task restructure– Threat recognition & adaptive response	<ul style="list-style-type: none">• Continue evolving technologies• Complete Phase 2 advanced autonomous tech development• Initiate Phase 3 advanced autonomous tech development <p><u>Beyond</u></p> <ul style="list-style-type: none">• Fully autonomous operations with periodic need for update• >75% prob of success in contested battlespace• Training/experience (warfighter culture) support inclusion of autonomous capabilities• Complete Phase 3 advanced autonomous tech development• Complete 3rd generation prototype

Overview of Autonomy Roadmap *





Notional Autonomy Roadmap *



* Comms and networking assumed available or adaptation

Headquarters U.S. Air Force

Integrity - Service - Excellence

AF Science, Technology, and Engineering Overview



Col Mark D. Koch
Associate Deputy Assistant Secretary
(Science, Technology, and Engineering)

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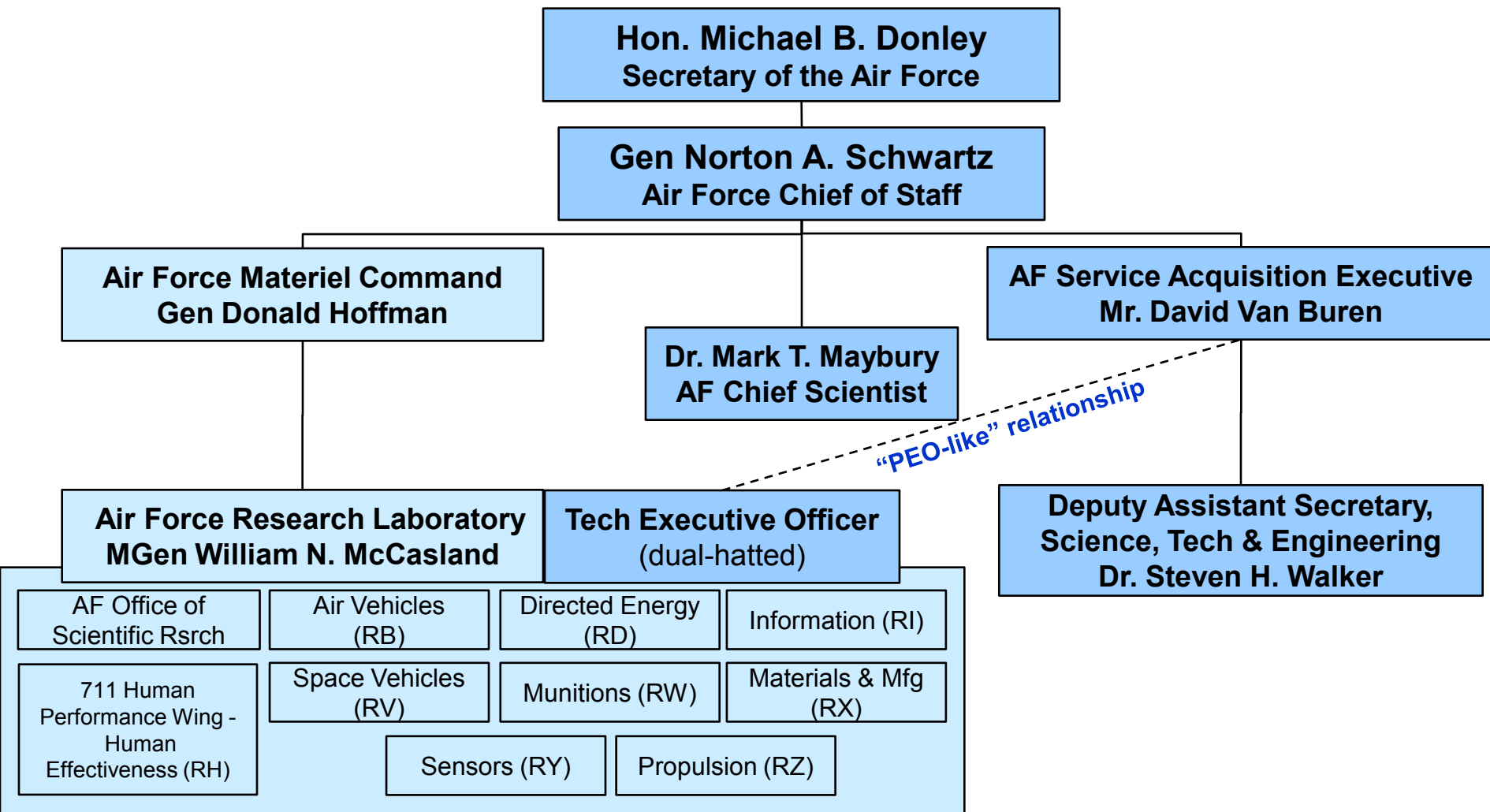
Agenda

- **AF S&T Organization**
- **AF S&T Vision**
- **SAF/AQR**
- **S&T Program Tenets**
- **S&T Program Priorities**
- **Strategy Development**
- **Summary**



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AF S&T Organization





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AF S&T Vision



Create compelling
air, space, and cyber
capabilities for
precise and reliable
Global Vigilance,
Reach and Power for
our Nation



U.S. AIR FORCE

SAF/AQR



**Deputy Assistant Secretary for
Science, Technology and Engineering
Dr. Steven Walker**

- Congressional
- Budget

**Associate Deputy Assistant Secretary
Col Mark D. Koch**

**Engineering &
Technical Mgt Division
(AQRE)**

**Strategy
Division
(AQRS)**

**Science & Technology
Division
(AQRT)**



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SAF/AQR Portfolio

Technical Advice to SAE

S&T Program Oversight



**Life Cycle Systems
Engr & Tech Policy**

“Functional Directorate” & “Capability Directorate”



S&T Strategy



S&E Career Field



Technology Transition



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S&T Program Tenets

- Prepare for an Uncertain Future and Investigate Game-Changers to Shape the Art-of-the Possible into Military Capabilities
- Create Technology Options that Address Urgent Warfighter Needs and Provide New AF Service Core Function Capabilities in Support of the Joint Mission
- Maintain In-House Expertise to Support the Acquisition and Operational Communities and Modernize and Improve the Sustainability of Unique Research Facilities and Infrastructure
- Develop Future Air Force Leaders with an Appreciation for the Value of Technology as a Force-Multiplier
- Remain Vigilant Over and Leverage Global S&T Developments and Emerging Capabilities



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S&T Program Priorities

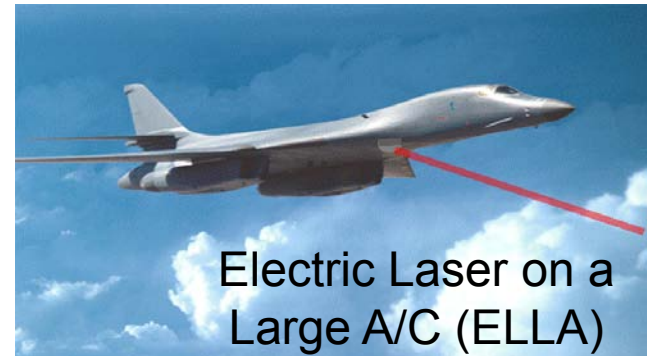
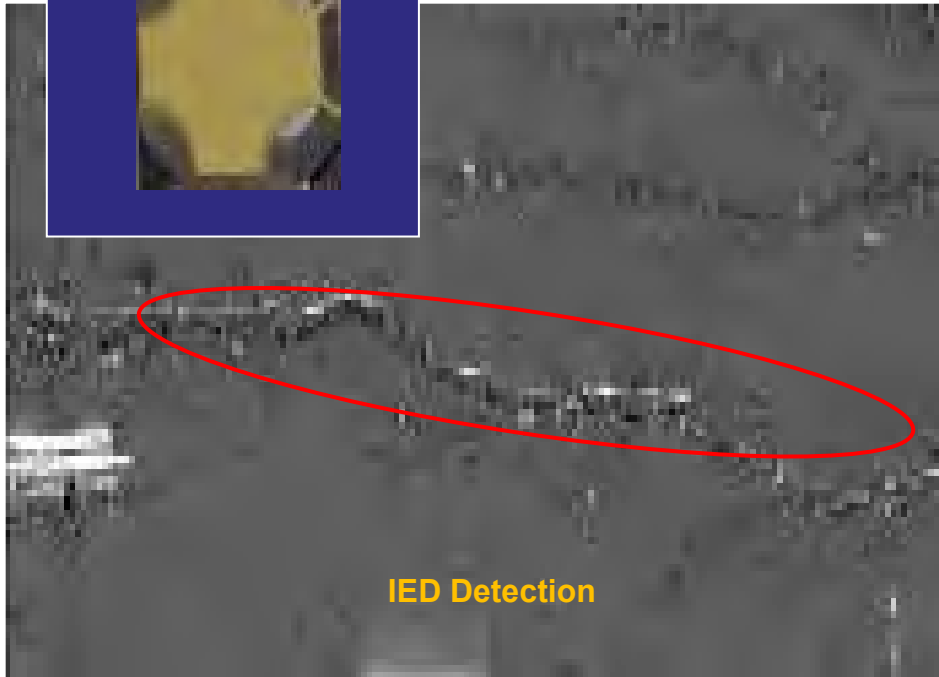
- **Priority 1:** Support the current fight while advancing breakthrough S&T for tomorrow's dominant warfighting capabilities
 - Enable the AF to operate effectively and achieve desired effects in all domains and all operations
 - Improve the agility, mobility, affordability and survivability of AF assets

The Right Balance - 6.1/6.2/6.3, All Domains, Performance vs. Affordability



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Support the Current Fight While Advancing Breakthrough Capabilities



Support the Current Fight... Advancing Tomorrow's Capabilities



S&T Program Priorities

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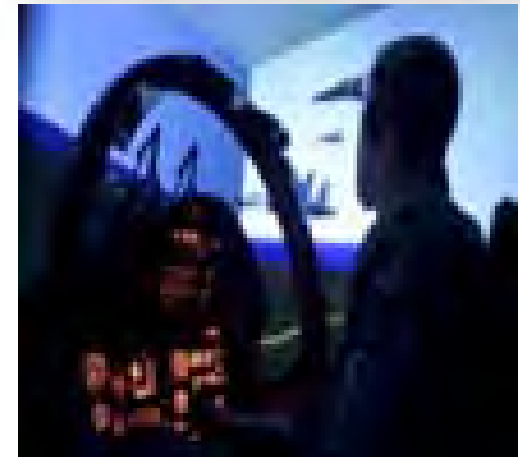
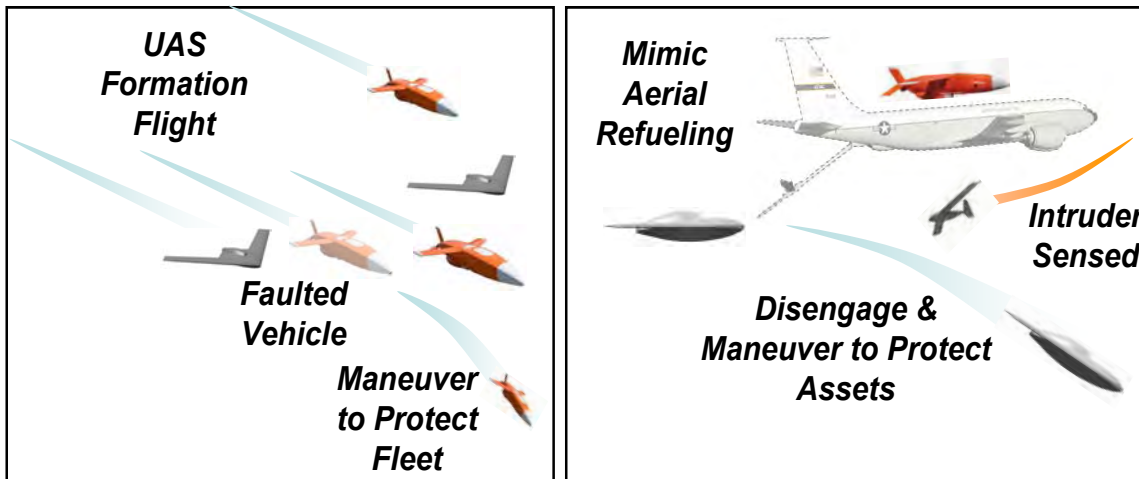
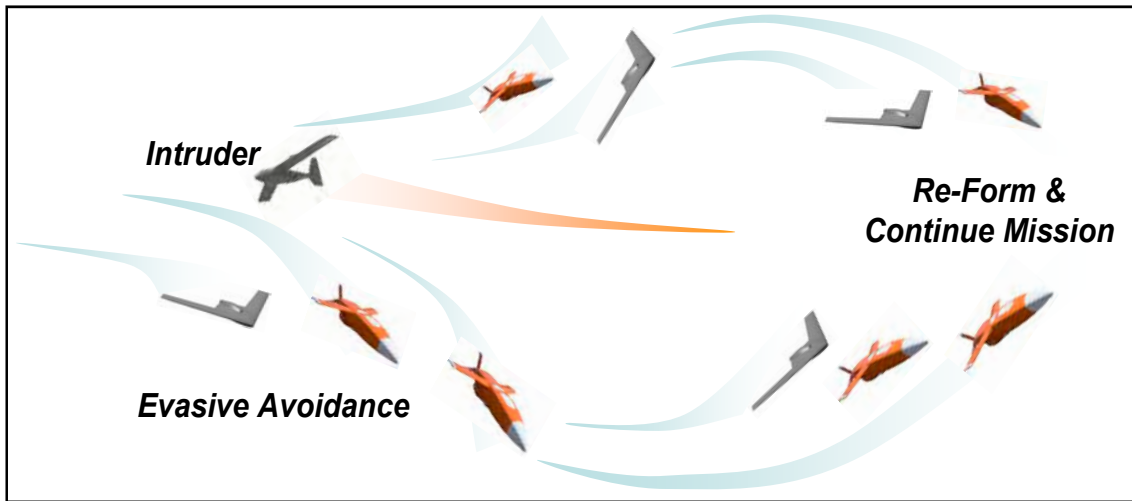
- **Priority 2:** Execute a balanced, integrated S&T Program that is responsive to AF Service Core Functions; Increase emphasis in S&T that will:
 - Improve the sustainment, affordability and availability of legacy systems
 - Reduce cyber vulnerabilities while emphasizing mission assurance
 - Support the needs of the nuclear enterprise
 - Deliver autonomous systems and human performance augmentation technologies envisioned in Technology Horizons
 - Provide robust situation awareness to enhance decision-makers' understanding and knowledge by improving ISR capabilities and data PED
 - Enable long-range precision strike
 - Reduce energy dependency

Where Do We Invest the Next Dollar



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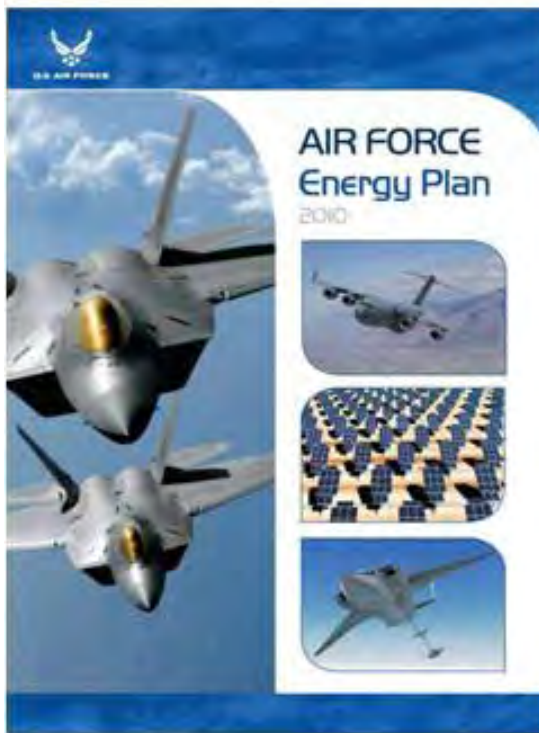
Delivering Human Performance Augmentation and Autonomy





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Reduce Energy Dependence



Change the Culture



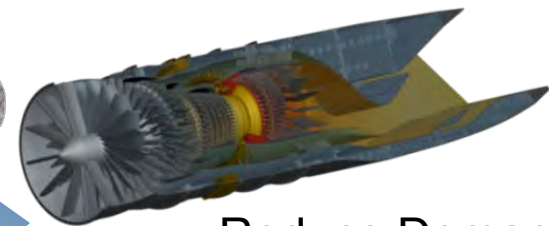
Seed Crops

Increase Supply

High Performance...



Fuel Efficiency...



Reduce Demand

*...Combined Into
Single Propulsion
System*

Make Energy A Consideration In All We Do



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S&T Program Priorities

- **Priority 3:** Retain and shape the critical competencies needed to address the full range of S&T product and support capabilities
 - Increase level of in-house basic research
 - Enhance critical competencies of the organic cyber workforce
 - Support AF STEM initiatives to develop and optimally manage the future S&E workforce

Shaping the Current and Future Workforce



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Retain and Shape Critical Competencies Internal to AFRL



Provide Organic Basic Research and Advanced Development Opportunities in Critical Areas



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Industrial Base

- Greater consideration given to non-domestic sources
- Greater need for acquisition and sustainment decision makers to be provided with usable, current IB information
- Greater need for the AF to provide clear guidance in terms of shaping the IB
 - Critical domestic capabilities – technologies and skill sets
 - Sufficient competition – supply chain management
 - Risk mitigation tools
- S&T community has an important role to play here



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S&T Program Priorities

- **Priority 4:** Ensure the AF S&T program is integrated into the AF Corporate requirements and programming processes
 - Be a trusted partner of the acquisition/sustainment community – assess tech maturity/enhance and accelerate tech transition
 - Leverage R&D efforts within industry – including small businesses
 - Develop and demonstrate technology solutions that decrease manufacturing risks

Bridge the Valley of Death



Flagship Capability Concept

U.S. AIR FORCE

- **Definition:** An integrated technology project collaboratively developed by MAJCOM(s), Center(s), and AFRL that:
 - Addresses a documented and prioritized MAJCOM capability need
 - Is commissioned via AF S&T Governance structure
 - Is traced to a CRRA Gap, linked to a Service Core Function Master Plan

- **Attributes:**
 - Initial systems engineering and development planning (DP) initiated
 - Somewhere between a leading DP concept and a prototype
 - Assigned to lead Center for transition
 - MAJCOM transition manager identified
 - Transition funding (6.4) committed two years prior to S&T completion
 - Defined S&T baseline/exit criteria
 - S&T project ideally completed during current FYDP



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Initial Set of Flagships

- 1. High Velocity Penetrating Weapon (HVPW)**
- 2. Responsive Reusable Boost for Space Access (RBS)**
- 3. Selective Cyber Operations Tech Integration (SCOTI)**



Flagships Helping Bridge the Valley of Death



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Strategy Development Efforts

- **Energy**
- **Cyber**
- **Hypersonics**
- **Space Situational Awareness**
- **Sustainment**



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X-51A Program Objective

Flight test the AF Hypersonic Technology (HyTech) scramjet engine, using endothermic hydrocarbon fuel, by accelerating a vehicle from boost ($\sim M=4.5$) to Mach 6+



Pratt & Whitney
A United Technologies Company

- Acquire ground and flight data on an actively cooled, self-controlled operating scramjet engine (rules and tools development)
- Demonstrate viability of an endothermically fueled scramjet in flight
- Prove viability of a free-flying, scramjet powered, vehicle (Thrust > Drag)



U.S. AIR FORCE

Survivable, High Speed Weapon

Enabling Capabilities

Hypersonic Air Vehicle and Propulsion Technologies Enable Long Range at High Speed with Effective Payload

Precision Strike

**Variable Warhead
Effects**

Long Range



**Aircraft Systems
Internal bombers
External fighters**

**Net Enabled
In-Flight Targetable**

High Speed

Rapid, Responsive Strike in Anti-Access/Access Denied (A2/AD) Environments



U.S. AIR FORCE

High Speed Aircraft

Capabilities and Attributes

Operation in A2/AD Environments

Penetrate Denied Areas (Survivable)

**Large ground coverage
area**

**High utility in space-
denied areas**

Mach 4+ Cruise



**Runway Takeoff and
Landing**

**Turbine Based
Combined Cycle**

**Reusable, Long-Life
Airframe**

On-Demand Flight in A2/AD Environments



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Summary

- Air Force Depends on the S&T Program to discover, develop, and demonstrate high-payoff technologies across all domains – *Tech Push*
- S&T Program Priorities, Program Tenets, and Processes aligned to turn science and knowledge into militarily relevant capabilities – *Tech Pull*
- Flagships linking S&T, Development Planning, and MAJCOM transition funding into HAF-commissioned AF Capabilities – *The Bridge Over The Valley of Death*
- Industrial Base, Engineering, and Technical Management – *Improving Acquisition Outcomes*

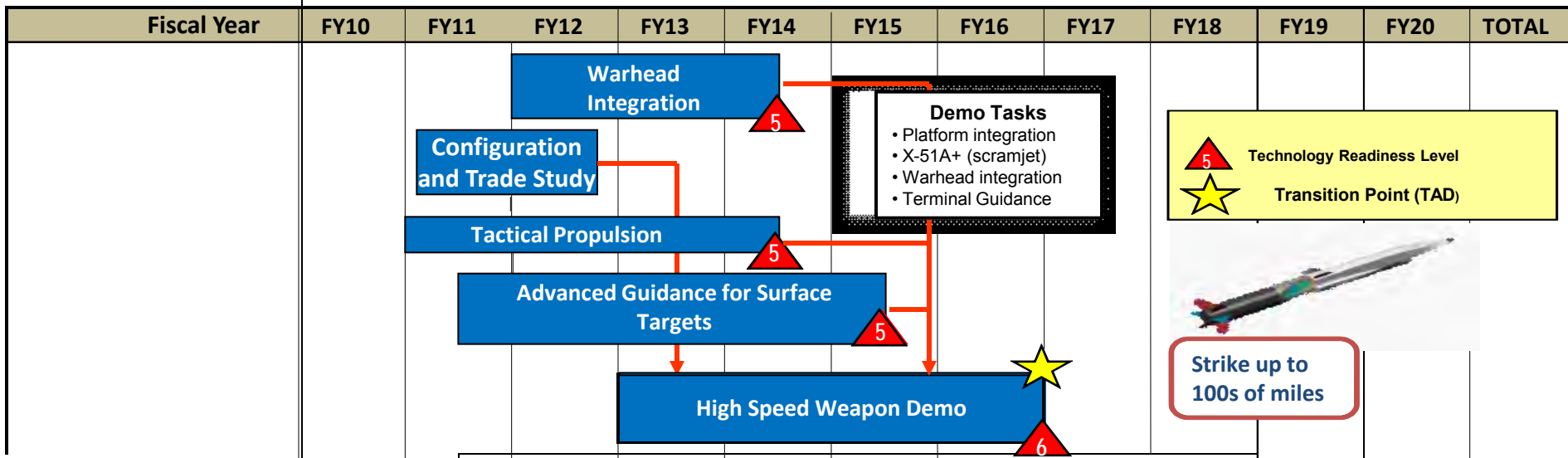


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BACKUPS



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TECHNOLOGY GAPS

- High Speed Multimode Seekers
- Anti Jam GPS
- Alternative high speed guidance (GPS denied environment)
- Compact energetic booster
- Aeroconfiguration, structures and materials, control surfaces, TPS
- Compatibility with current and emerging fighters and bombers
- Compatibility with Navy/VLS



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Revitalizing Development Planning (DP)

Weapon Systems Acquisition Reform Act (WSARA) of 2009 requires:

Director, Systems Engineering to “Review the organizations & capabilities of the military departments with respect to...*development planning* ...and identify needed changes or improvements”

SAE to “develop & implement plans to ensure the military dept has provided appropriate resources for:

Development planning and systems engineering organizations with adequate numbers of trained personnel”





What is Development Planning?

U.S. AIR FORCE

- Acquisition contribution to AF-level capability planning
- Early analyses of technical issues, risks, and resources
 - Inform sponsors and decision makers on realm of the possible
 - Greatest leverage prior to Materiel Development Decision
- Systems engineering efforts define the trade space of concepts
- DP activities foundation for new system development
- Results in high-confidence estimates of cost, schedule, and technical performance



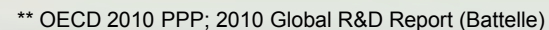
Naval S&T Overview



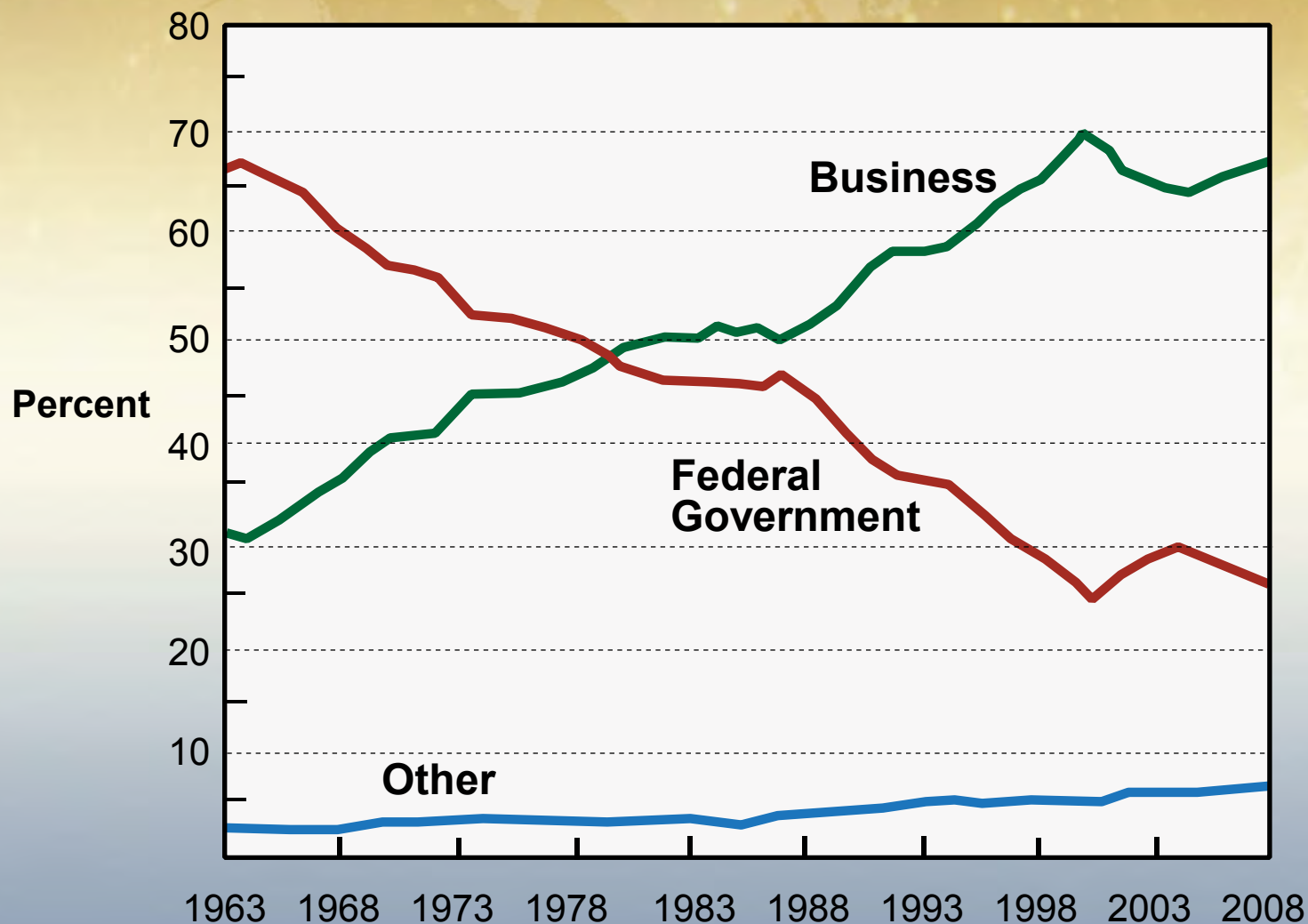
Revolutionary Research . . . Relevant Results

Dr. Joseph Lawrence
Director of Transition
Office of Naval Research
June 22, 2011

O F F I C E O F N A V A L R E S E A R C H

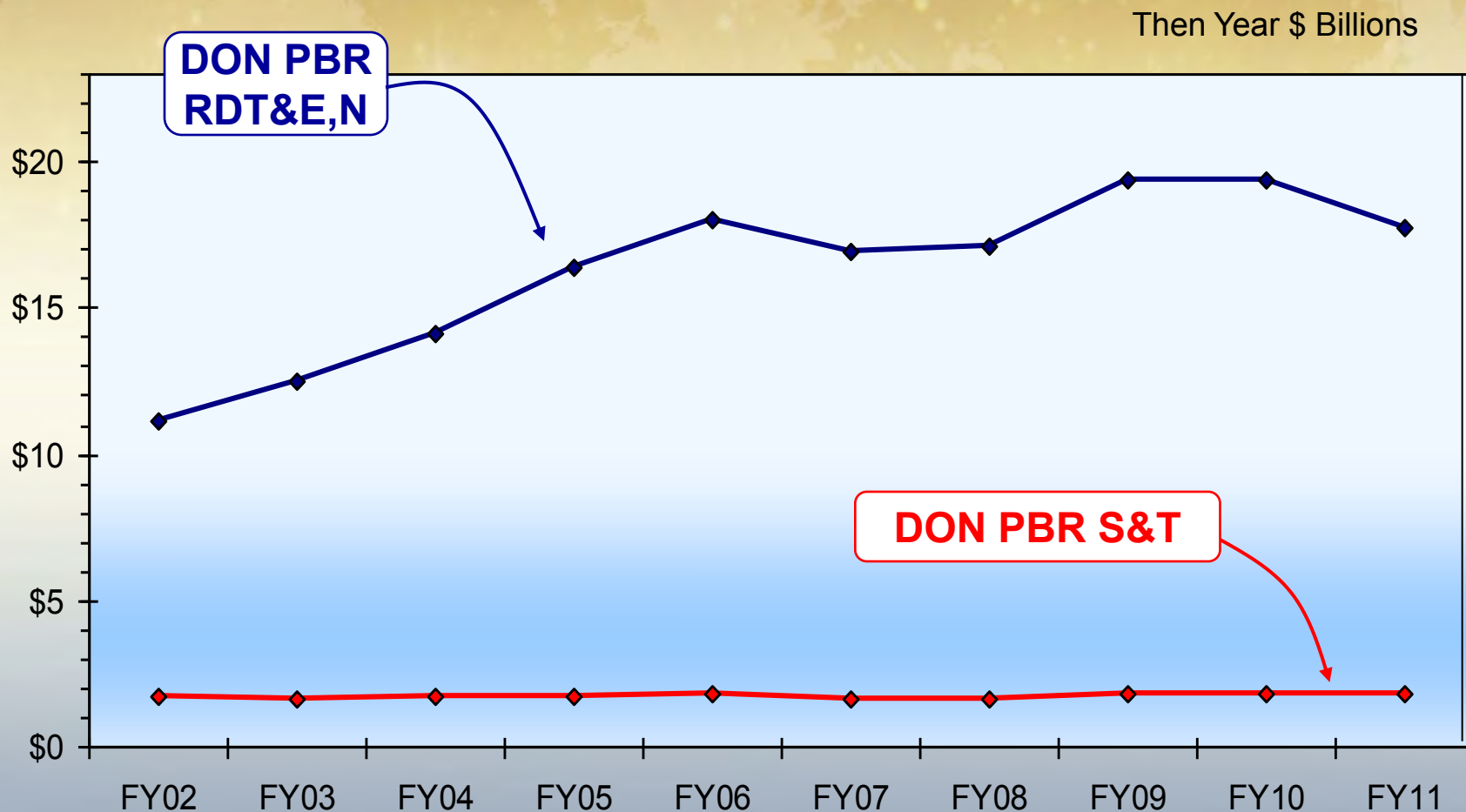


R&D Investment Trends



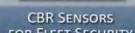
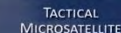
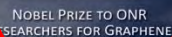
Source: National Science Foundation, Division of Science Resource Statistics,
Science and Engineering Indicators 2010

RDT&E 6.1 – 6.7



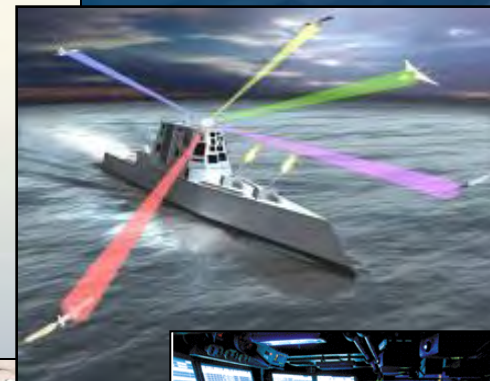
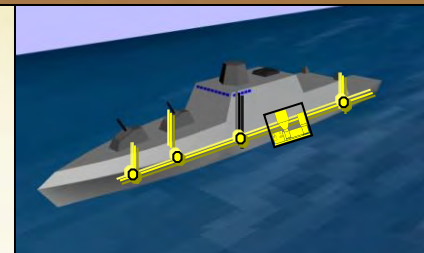


ACCOMPLISHMENTS ACROSS ALL DOMAINS



..... And Looking Ahead

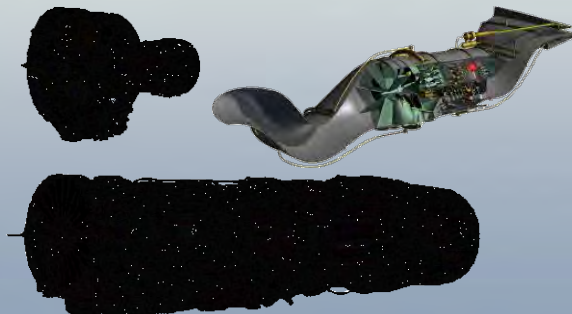
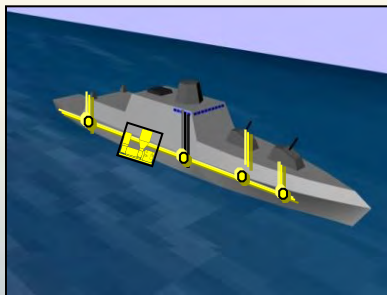
- Power & Energy
- Directed Energy & Hypersonics
- Information Dominance
- Autonomous Systems
- Total Ownership Cost Reduction
- Naval Warfighter Performance



Power & Energy

1. Sail a "Green Strike Group" by 2016
2. 50% of Navy energy from alternative sources by 2020,

- Fuels
- Power Generation
- Energy Storage
- Efficient Distribution
- Energy Usage



Directed Energy & Hypersonics

- Fight at Hypervelocity & Speed of Light
- Deepen the Magazines
- Increase Depth of Fire
- Broad Range of Missions



Dominating the Electromagnetic Spectrum

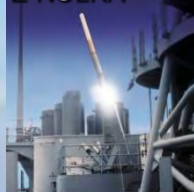
NULKA



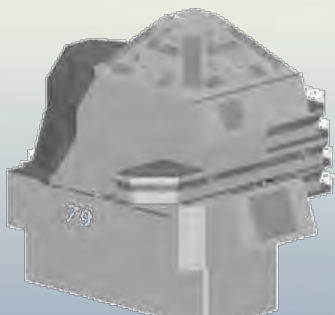
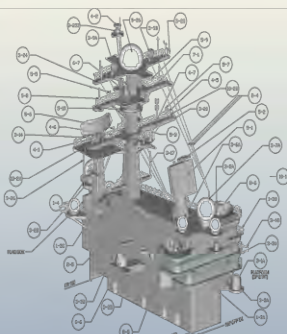
AN/SLQ-32



E-NULKA



RF Onboard Countermeasures



Integrated Topside Innovative Naval Prototype Program (INTOP)

Integrated Distributed EW

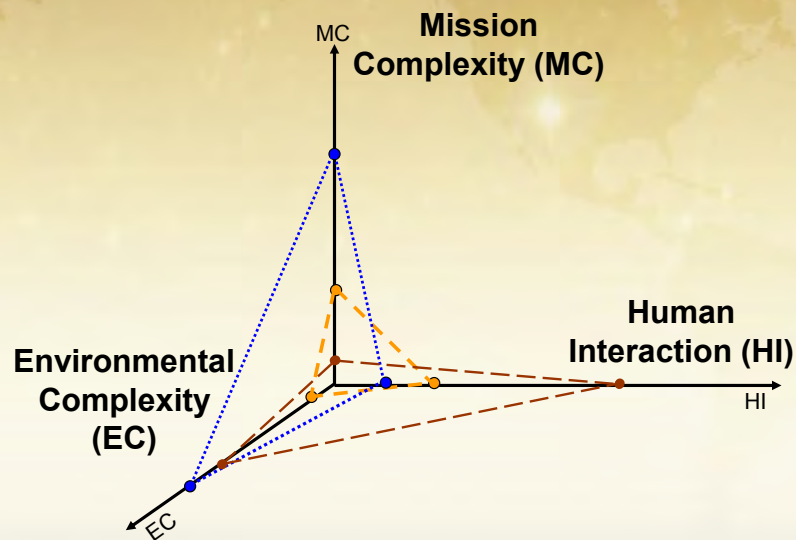
Integrated Distributed Electronic Warfare



Wide-Area MOSA CM Technologies



Autonomy

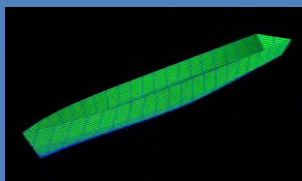


- **Changes everything**
 - Tactics to strategy
- **Hybrid force with manned systems**
- **Power & Energy implications**
- **Mission CONOPS development**



Total Ownership Cost

Design



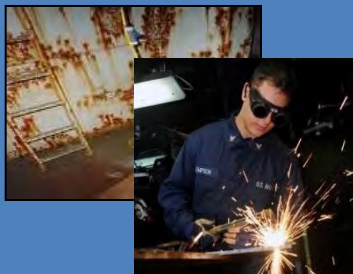
10%

Acquisition

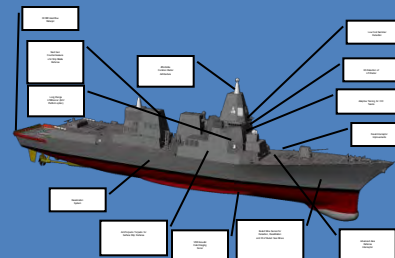


20-30%

Operations & Support



Modernization



Disposal



60-70%

Naval Warfighter Performance

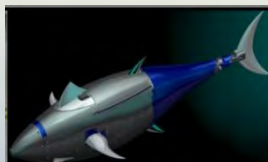
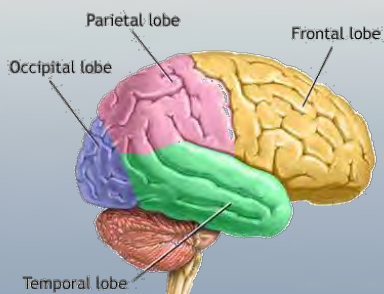
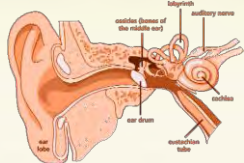
Human Systems Integration

- Manpower & Personnel Management
- Training & Digital Tutors
- User-Centered Design
- C2 Decision Support
- Human, Social, Cultural Sciences
- Safety / Hearing



Bio-Engineered Systems

- Marine Mammal Health
- Bio-Sensors / Materials
- Microbial Fuel Cells
- Bio Robotics
- Human-Autonomy Systems

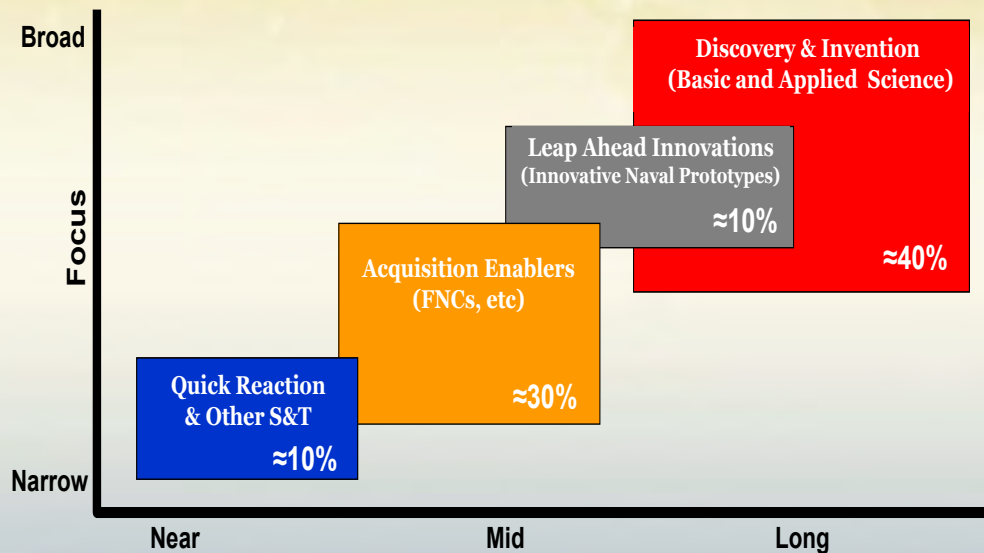


Undersea & Expeditionary Medicine

- Undersea Medicine (NNR)
- Point of Injury Care
 - "Lighten the Load"
 - Treat hemorrhagic shock
- Automated Medical Care
 - CASEVAC / Patient Movement



Naval S&T Strategic Plan



Focus Areas

- Power and Energy
- Operational Environments
- Maritime Domain Awareness
- Asymmetric & Irregular Warfare
- Information Superiority and Communication
- Power Projection
- Assure Access and Hold at Risk
- Distributed Operations
- Naval Warfighter Performance
- Survivability and Self-Defense
- Platform Mobility
- Fleet/Force Sustainment
- Total Ownership Cost



Tech Solutions



FNCs



INPs



D&I



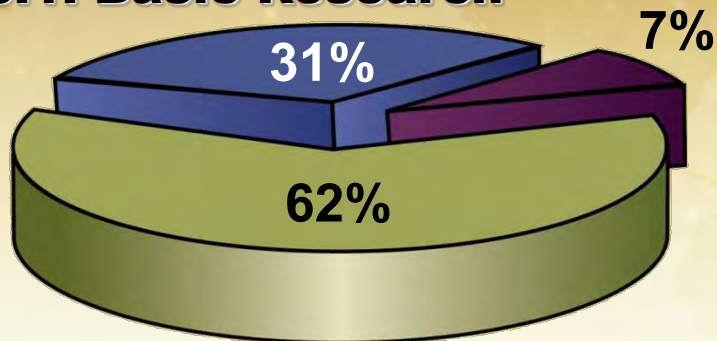
How We Execute



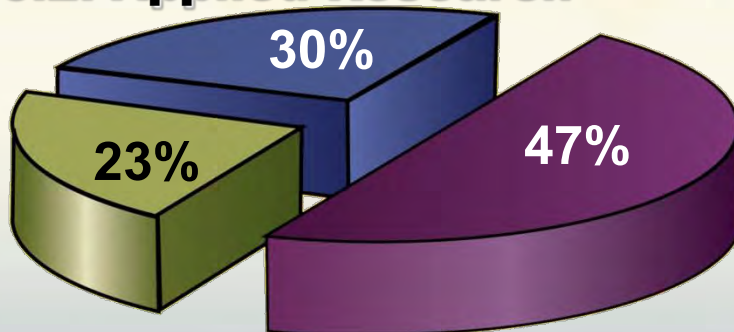
- 70 Countries
- 50 States
- 1,078 Companies
 - 859 small businesses
- 1,035 Universities & Nonprofit Entities
 - 3,340 principal investigators
 - 3,000 grad students

Investment Balance

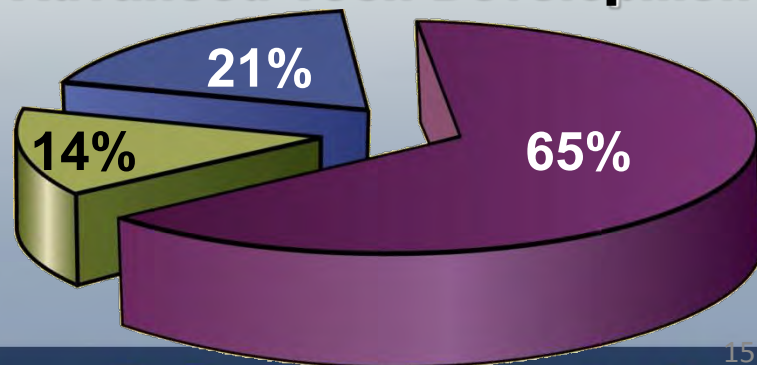
6.1: Basic Research



6.2: Applied Research



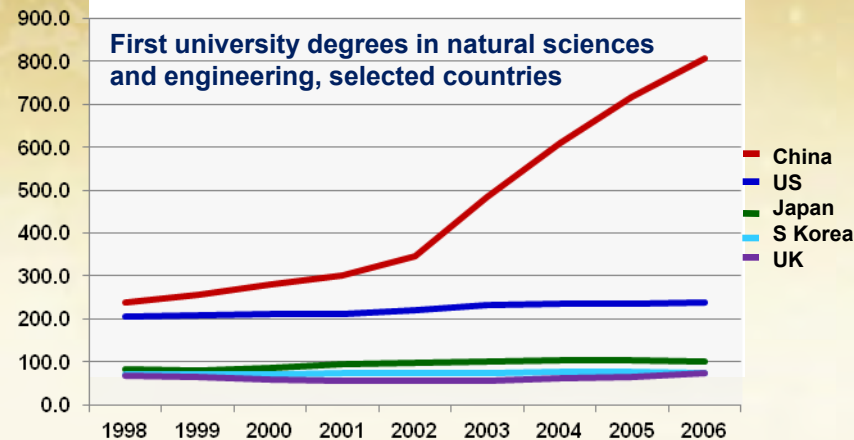
6.3: Advanced Tech Development



STEM



www.STEM2Stern.org



PhD Engineering
Total: 2,380

PhD Natural Science & Engineering
Total: 11,189

MS Natural Science & Engineering
Total: 43,104

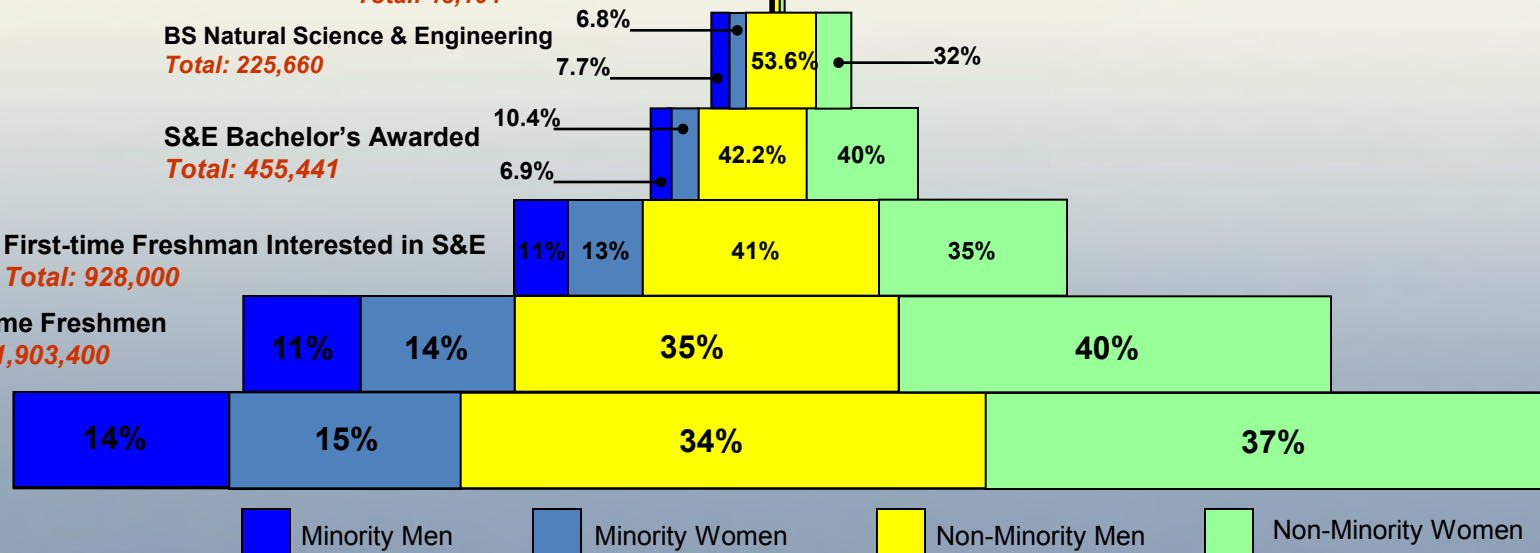
BS Natural Science & Engineering
Total: 225,660

S&E Bachelor's Awarded
Total: 455,441

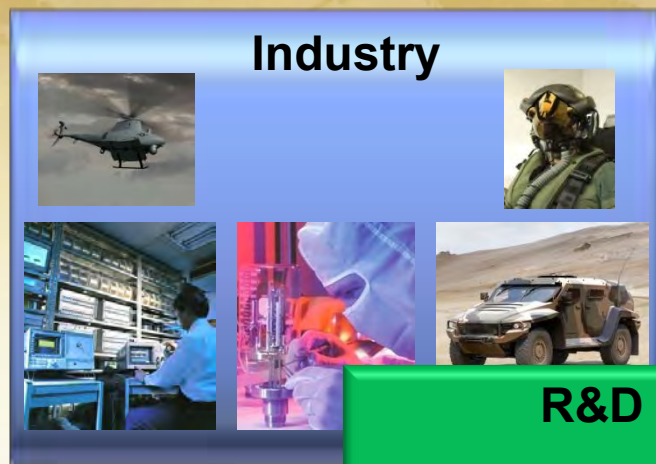
First-time Freshman Interested in S&E
Total: 928,000

First-time Freshmen
Total: 1,903,400

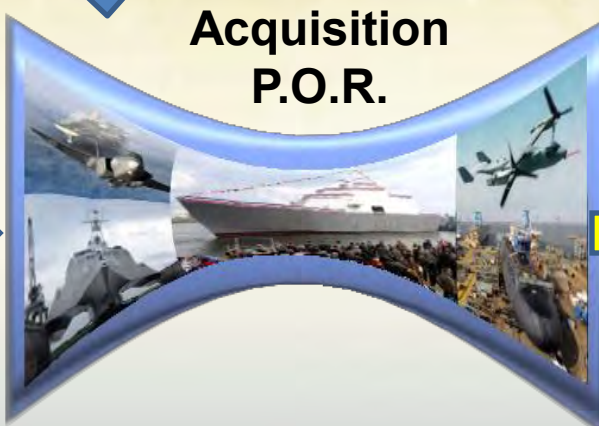
High School Graduates
Total: 3,115,220



Speed to Fleet



R&D
 6.4-6.8
 \$\$



Academia



S&T
 6.1-6.3
 \$\$

6.4
 \$\$

Why it Matters



***"I never, ever, want to see a Sailor
or a Marine in a fair fight!"***

*-Adm. Gary Roughead
Chief of Naval Operations*



We Want To Hear From You!

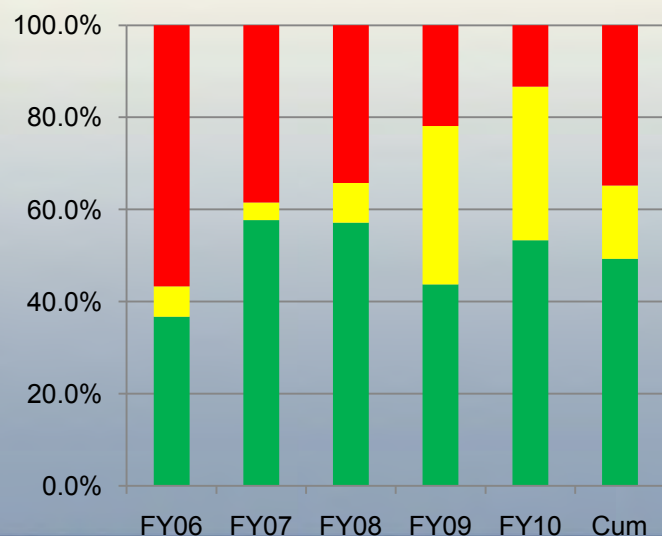
- *ONR Website:*
www.onr.navy.mil
- *ONR Central Phone Number:*
703-696-5031

Back-up

Transitions

Successfully delivered 83% of the FNCs to Acquisition

FNC Delivery Year	Products Planned to Deliver	Products Delivered to Acquisition	Deployed	On-Track for Deployment	Still With Acquisition Program	Did Not Transition
FY10	19	15	1	7	5	2 (13%)
FY09	35	32	2	12	11	7 (22%)
FY08	47	35	8	12	3	12 (34%)
FY07	32	26	7	8	1	10 (38%)
FY06	<u>34</u>	<u>30</u>	<u>7</u>	<u>4</u>	<u>2</u>	<u>17 (57%)</u>
Total	167	138	25	43	22	48 (35%)

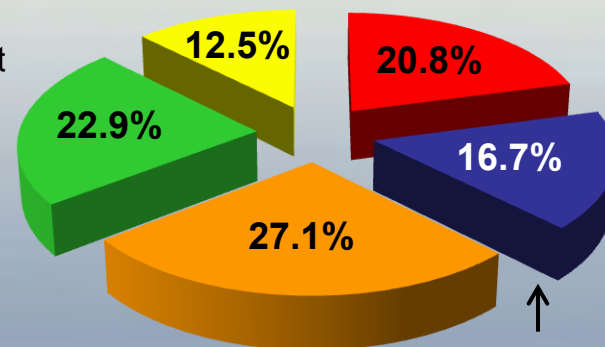


Forensics

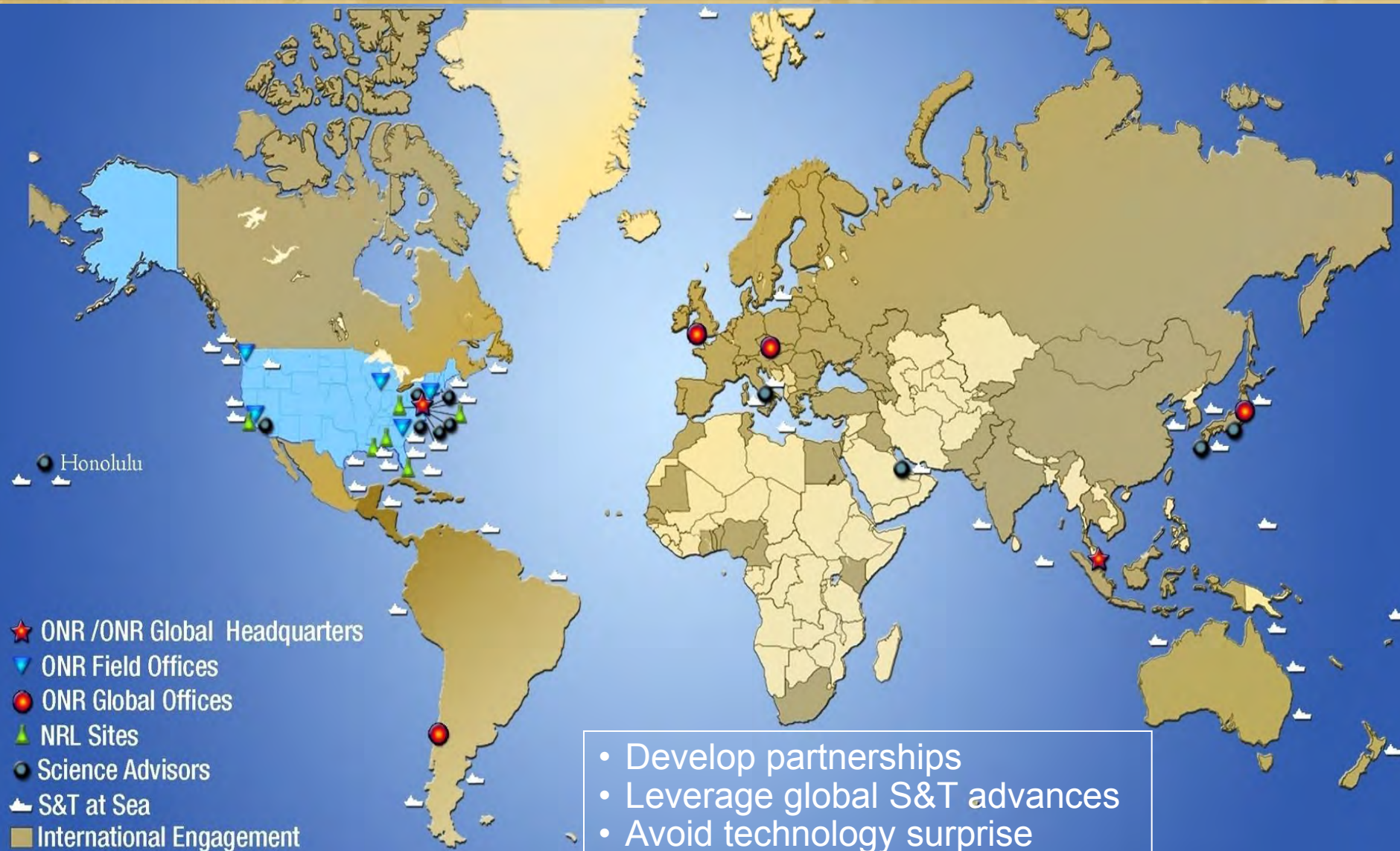
Technology Lost in Acquisition Competition

PMO Lost Interest

Acquisition Strategy Significantly Modified



ONR Global



A Great Place to Work

- *#1 “Best Place to Work” in the Navy*
 - *Partnership for Public Service*
- *“Most Admired Employer”*
 - *Black Engineer magazine*
 - *Hispanic Engineer magazine*
 - *Women of Color magazine*
- *#1 Patent Portfolio worldwide among government agencies from IEEE Patent Power Scorecard*
 - *232 patents in 2009*
- *Popular Science Magazine’s 2010 Best of What's New Winner*
 - *NEAH Power Systems' Infinity Fuel Cells*
- *TIME Magazine’s “Best Inventions of the Year”*
 - *2009: Microbial Fuel Cell*
 - *2008: NEXI, MEMRISTOR*



POPSCI

TIME

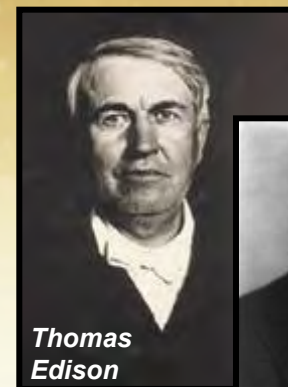
The Office of Naval Research

Naval Research Laboratory (*Appropriations Act, 1916*)

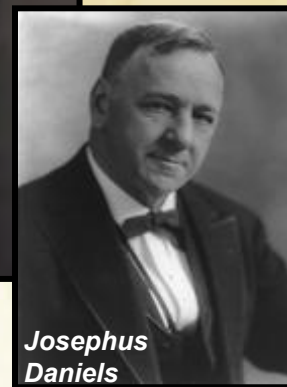
"[Conduct] exploratory and research work...necessary ...for the benefit of Government service, including the construction, equipment, and operation of a laboratory...."

Office of Naval Research (*Public Law 588, 1946*)

"...plan, foster, and encourage scientific research in recognition of its paramount importance as related to the maintenance of future of naval power, and the preservation of national security..."



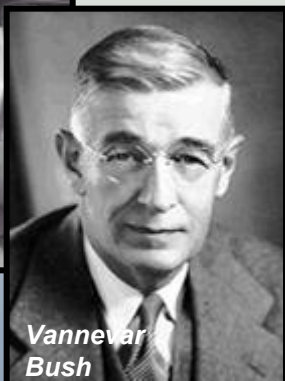
Thomas
Edison



Josephus
Daniels



Harry S.
Truman



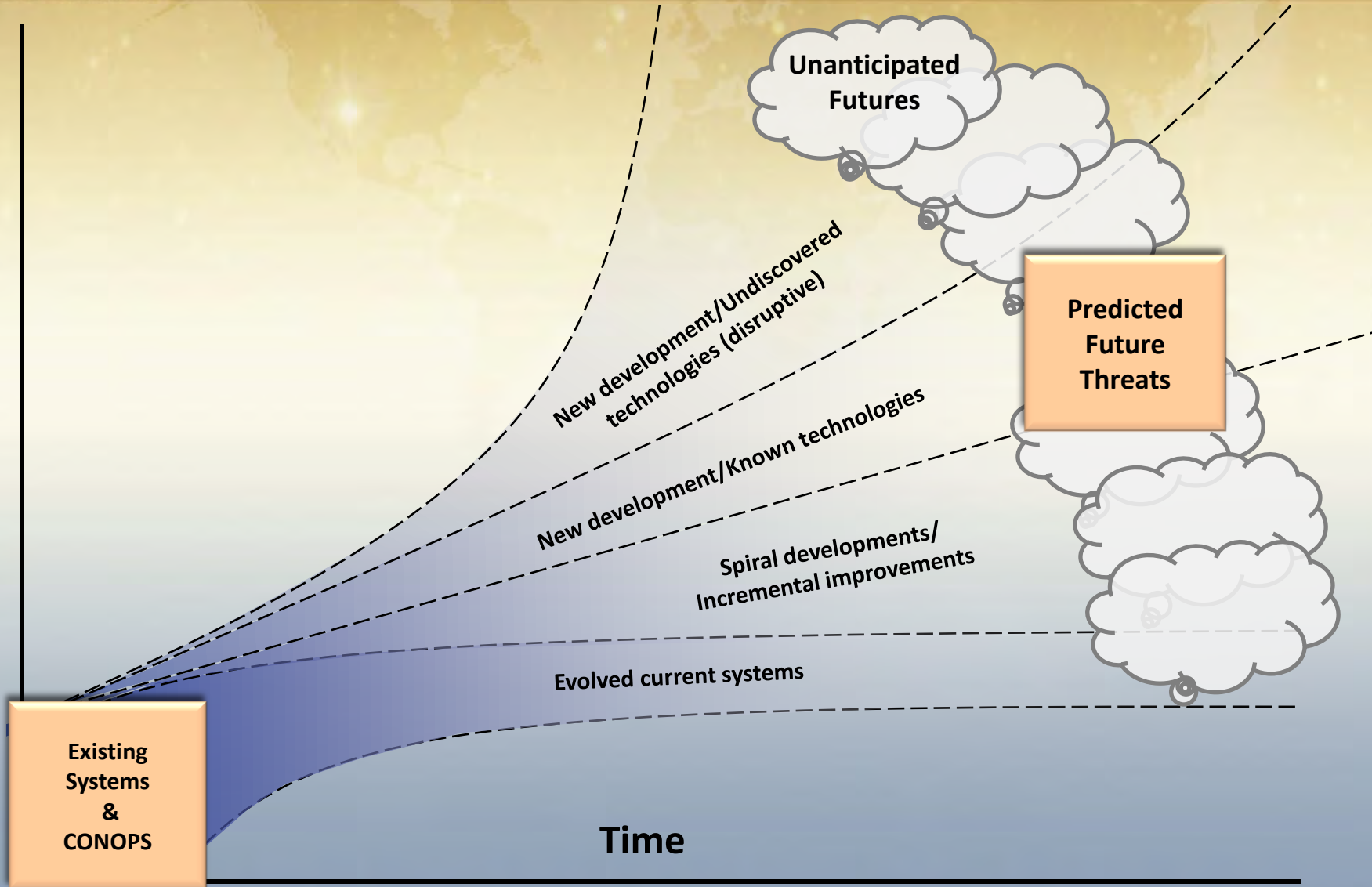
Vannevar
Bush

Transitioning S&T (*Defense Authorization Act, 2001*)

"...manage the Navy's basic, applied, and advanced research to foster transition from science and technology to higher levels of research, development, test, and evaluation."

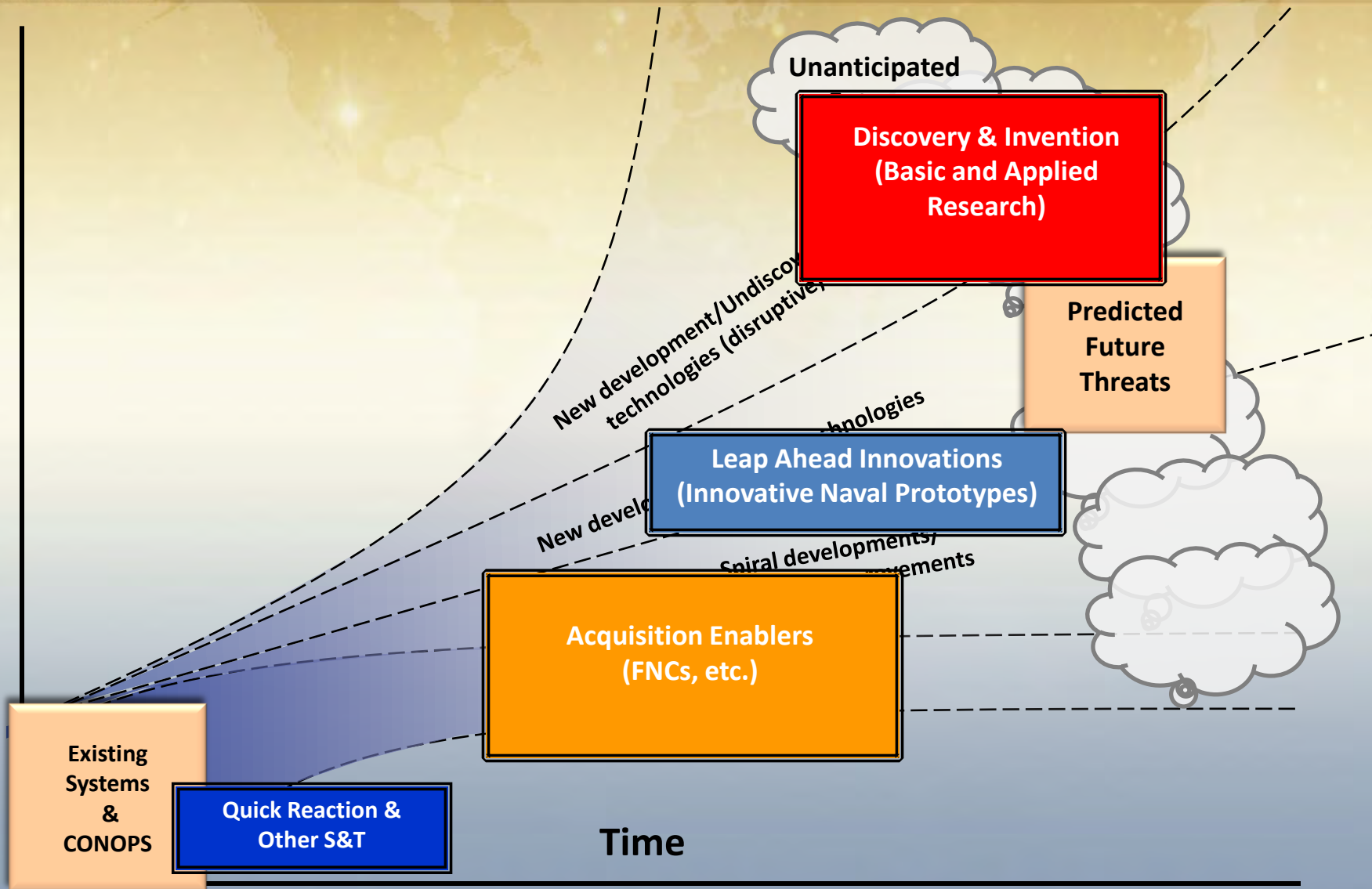
Uncertain Future

Complexity...Uncertainty...Warfighting Capability

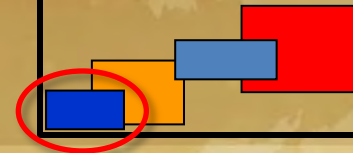
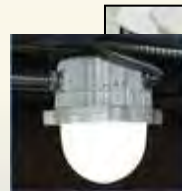


Uncertain Future

Complexity...Uncertainty...Warfighting Capability



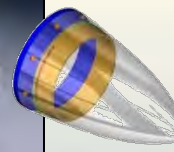
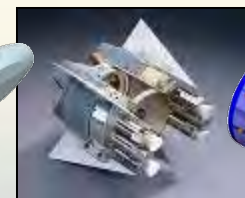
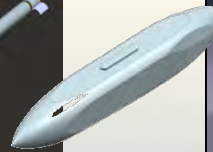
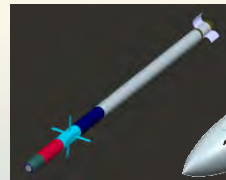
Quick Reaction S&T (1-2 Year) Off-The-Shelf Technologies

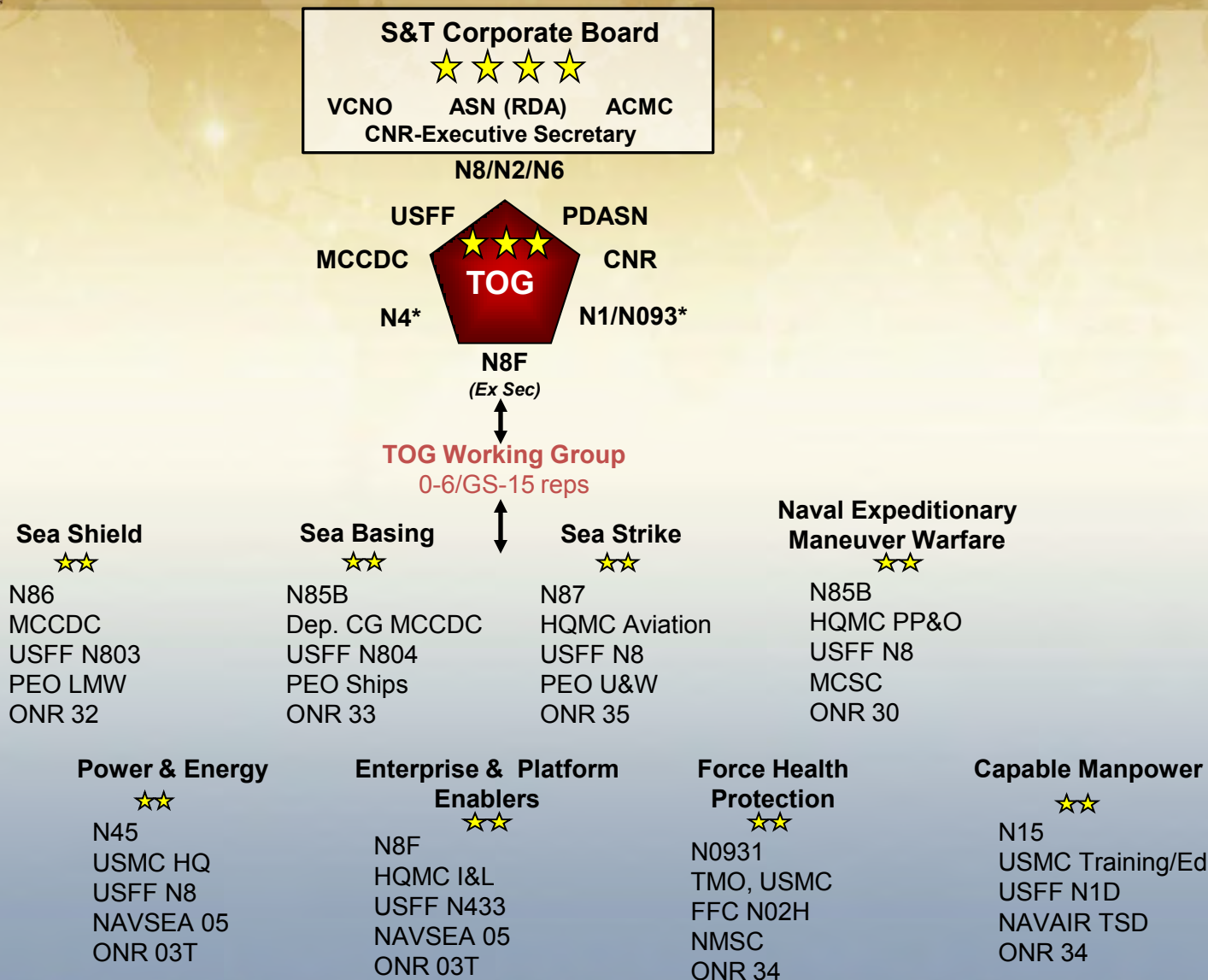
- Rapid solutions to problems identified by deckplate Sailors and Marines
- 1 year turnaround time
- Video: www.youtube.com/usnavyresearch
- Requests submitted online
www.onr.navy.mil/techsolutions

Future Naval Capabilities

(3-5 Year) Component Technologies



Technology Oversight Group



Innovative Naval Prototypes

(5-10 Year) Disruptive Technologies

- High Risk / High Payoff
- Innovative and game-changing
- Approved by Corporate Board
- Delivers prototype



Tactical Satellite



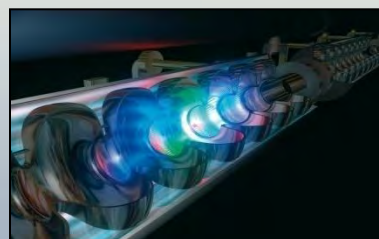
EM Railgun



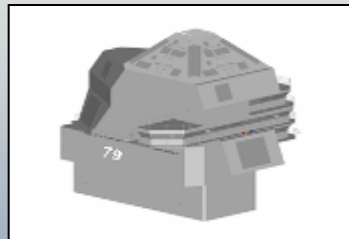
Persistent Littoral Undersea Surveillance



Sea Base Enablers



Free Electron Laser



Integrated Topside



Large Displacement UUV



AACUS

Basic Research

(1-25 Year) Undiscovered & Emerging Technologies

- Diverse portfolio
- Fosters innovation
- Long-term
- Investment in people
 * 56 Nobel laureates



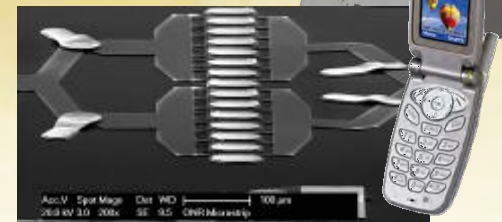
EW



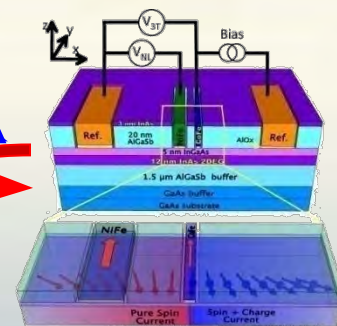
1st U.S. Intel satellite
 GRAB



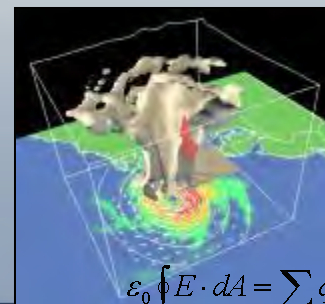
Semiconductors
 GaAs, GaN, SiC



Spintronics



Weather Modeling



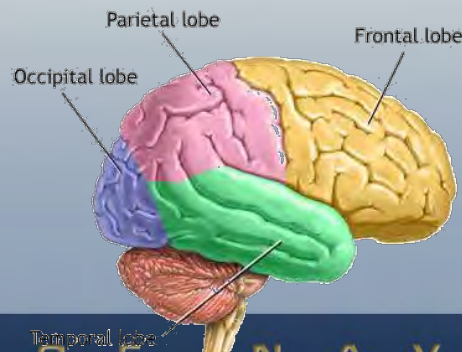
Laser Cooling



GPS



Arctic Research



The Challenge: “Speed to Fleet”



***“I never, ever, want to see a Sailor or a Marine
in a fair fight! ... We have to get technology to the
Fleet faster.”***

- Adm. Gary Roughead, Chief of Naval Operations



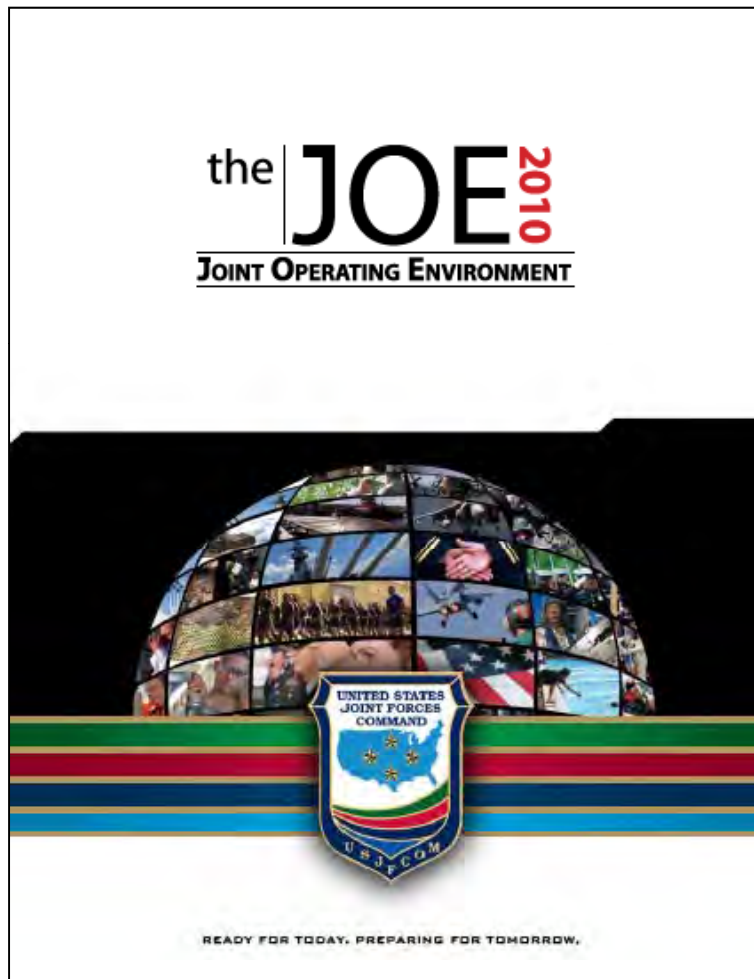
Shaping the Department's S&T Strategy

21 June 2011

The Honorable Zachary J. Lemnios
Assistant Secretary of Defense for
Research and Engineering



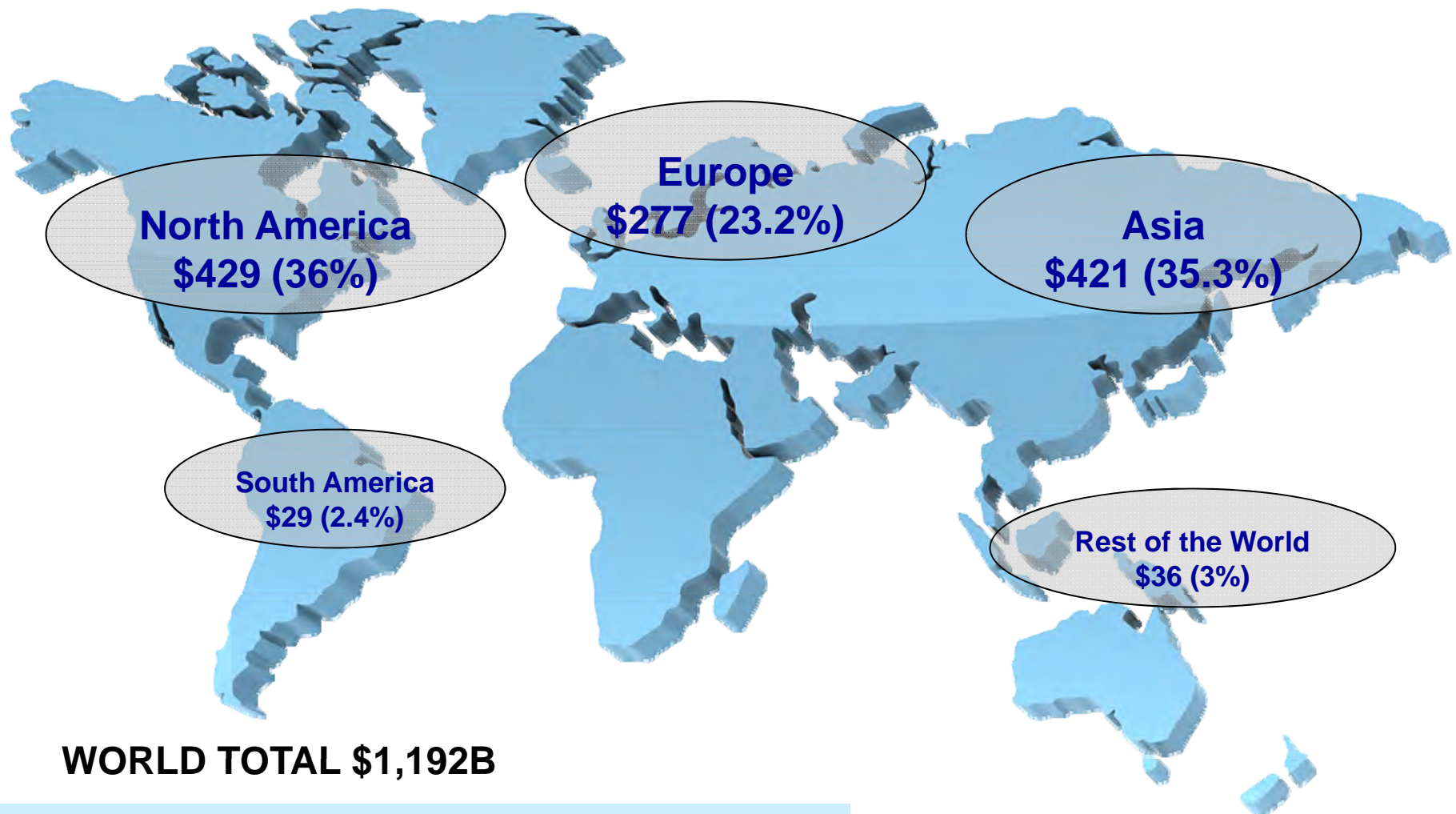
Global Challenges and Trends



- **Shifting Global Demographics**
- **Globalization shifts**
- **Energy**
- **Climate change & natural disasters**
- **Cyber as a new domain**
- **Challenges to existing state structures**
- **WMD proliferation**



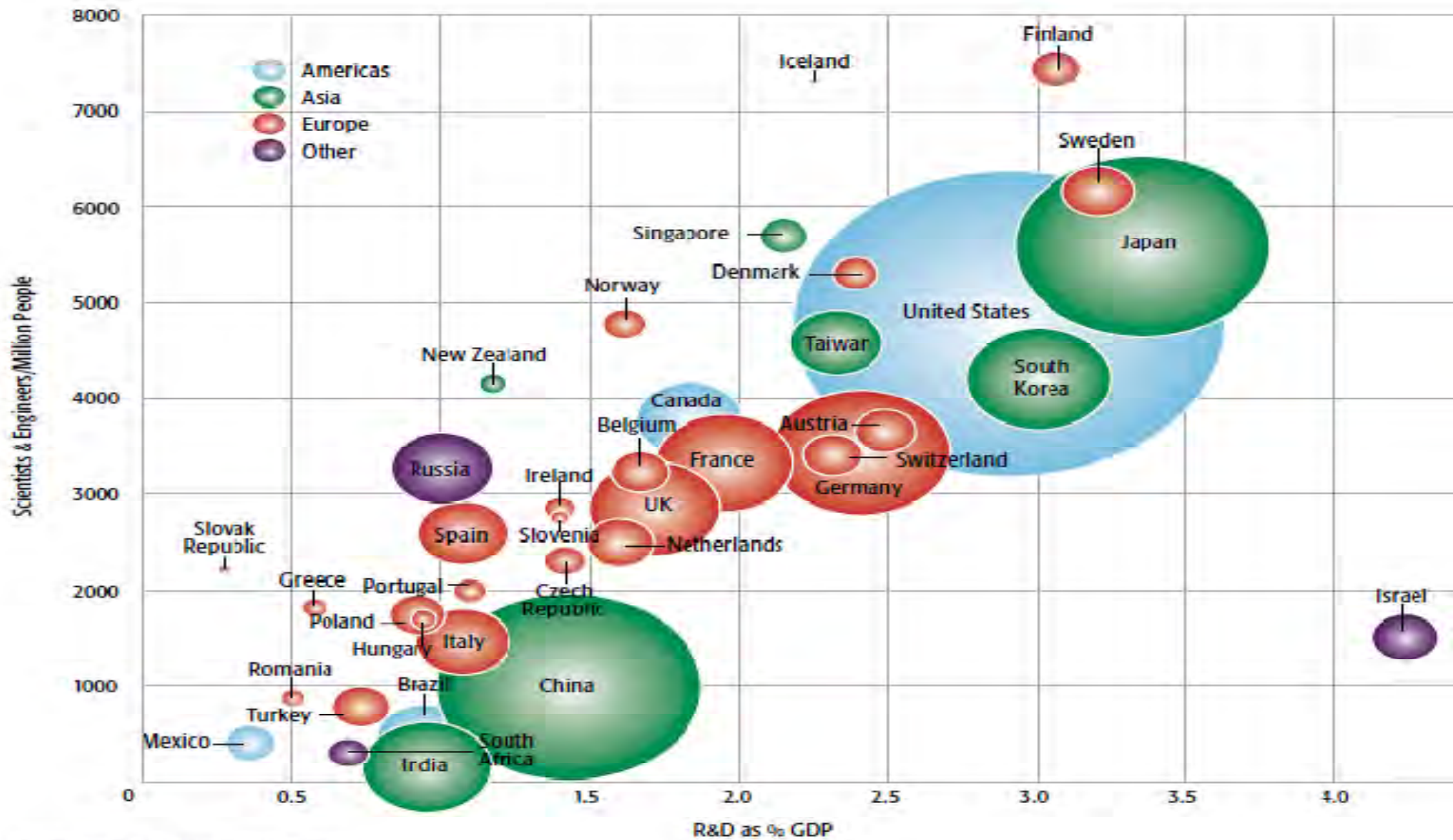
Globalization of R&D



Source: www.rdmag.com "2011 Global R&D Funding Forecast" - Battelle



World R&D Trends: A Global Shift



Source: Battelle, R&D Magazine, OECD, IMF, CIA



Guidance Roadmap



Target Affordability and Control Cost Growth

- Mandate affordability as a requirement
 - At Milestone A set affordability target as a Key Performance Parameter

Improve Tradecraft in Services Acquisition

- Create a senior manager for acquisition of services in each component, following the Air Force's example
- Adopt uniform taxonomy for different types of services

• Target Affordability and Control Cost Growth

• Incentivize Productivity & Innovation in Industry

• Promote Real Competition

• Improve Tradecraft in Service Acquisition

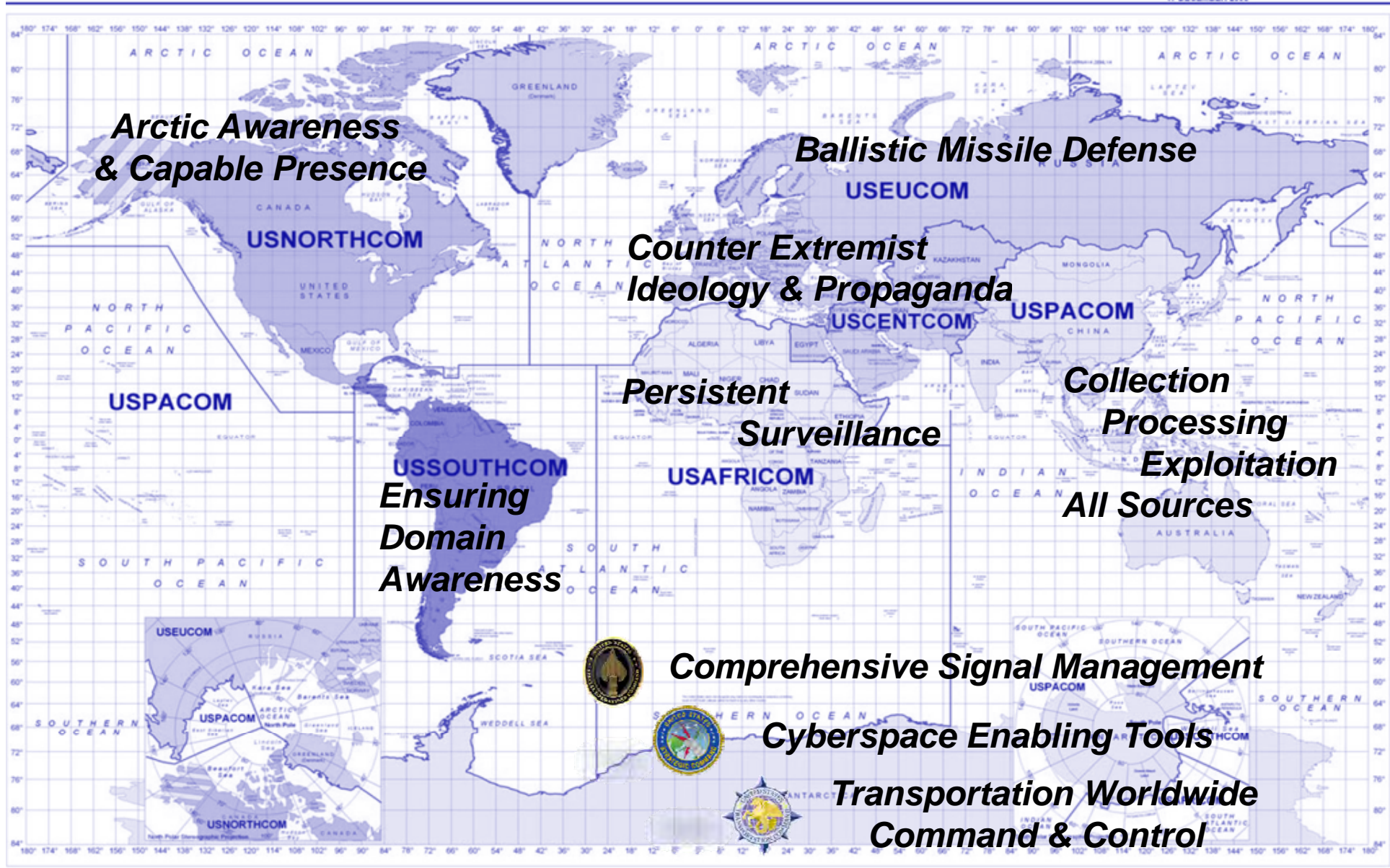
• Reduce Non-Productive Processes and Bureaucracy

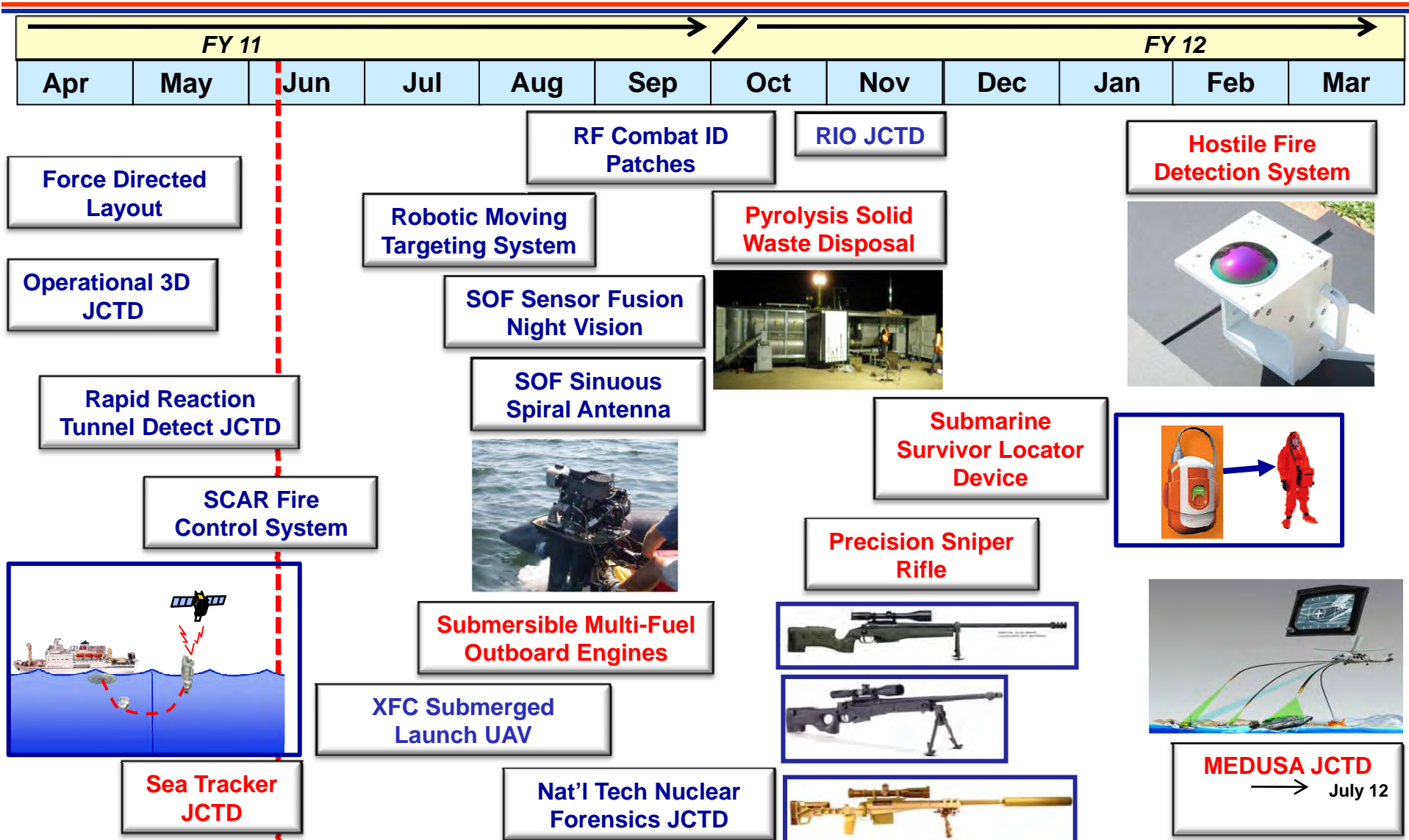
- Require open system architectures and set rules for acquisition of technical data rights
- Increase dynamic small business role in defense marketplace competition

n
and prevent
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re-compete of
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ontain cost
ces
sary to support
o significant
ressional
plementary
(FPRRs) to



Support to Combatant Commanders







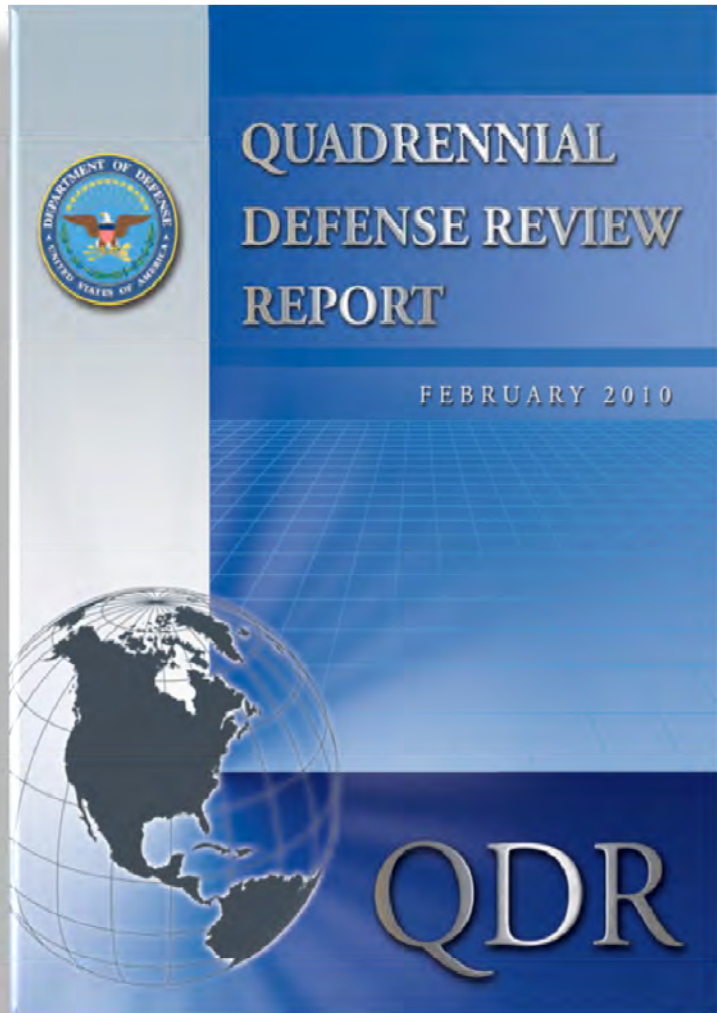
Imperatives



- 1. Accelerate delivery of technical capabilities to win the current fight.**
- 2. Prepare for an uncertain future.**
- 3. Reduce the cost, acquisition time and risk of our major defense acquisition programs.**
- 4. Develop world class science, technology, engineering, and mathematics capabilities for the DoD and the Nation.**



Quadrennial Defense Review Missions Require New Capabilities



1. **Defend the United States and Support Civil Authorities at Home**
2. **Succeed in Counterinsurgency, Stability, and Counterterrorist Operations**
3. **Build the Security Capacity of Partner States**
4. **Deter and Defeat Aggression in Anti-Access Environments**
5. **Prevent Proliferation and Counter Weapons of Mass Destruction**
6. **Operate Effectively in Cyberspace.**



Capability Priorities for FY13-17



Complex Threats

**Electronic Warfare /
Electronic Protection**

**Cyber Science and
Technology**

**Counter Weapons of
Mass Destruction**

Force Multipliers

Data-to-Decisions

Autonomy

**Engineered Resilient
Systems**

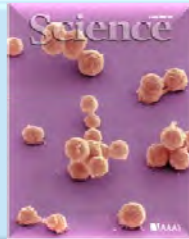
Human Systems



High Interest Basic Science Areas



Synthetic Biology



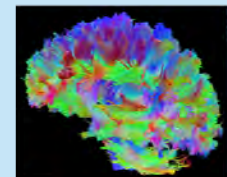
Human Behavior Modeling



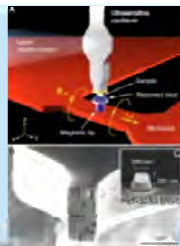
Novel Engineered Materials



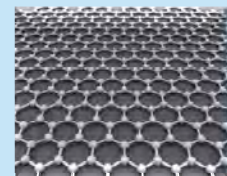
Cognitive Neuroscience



Quantum Information Science



Nanoscience



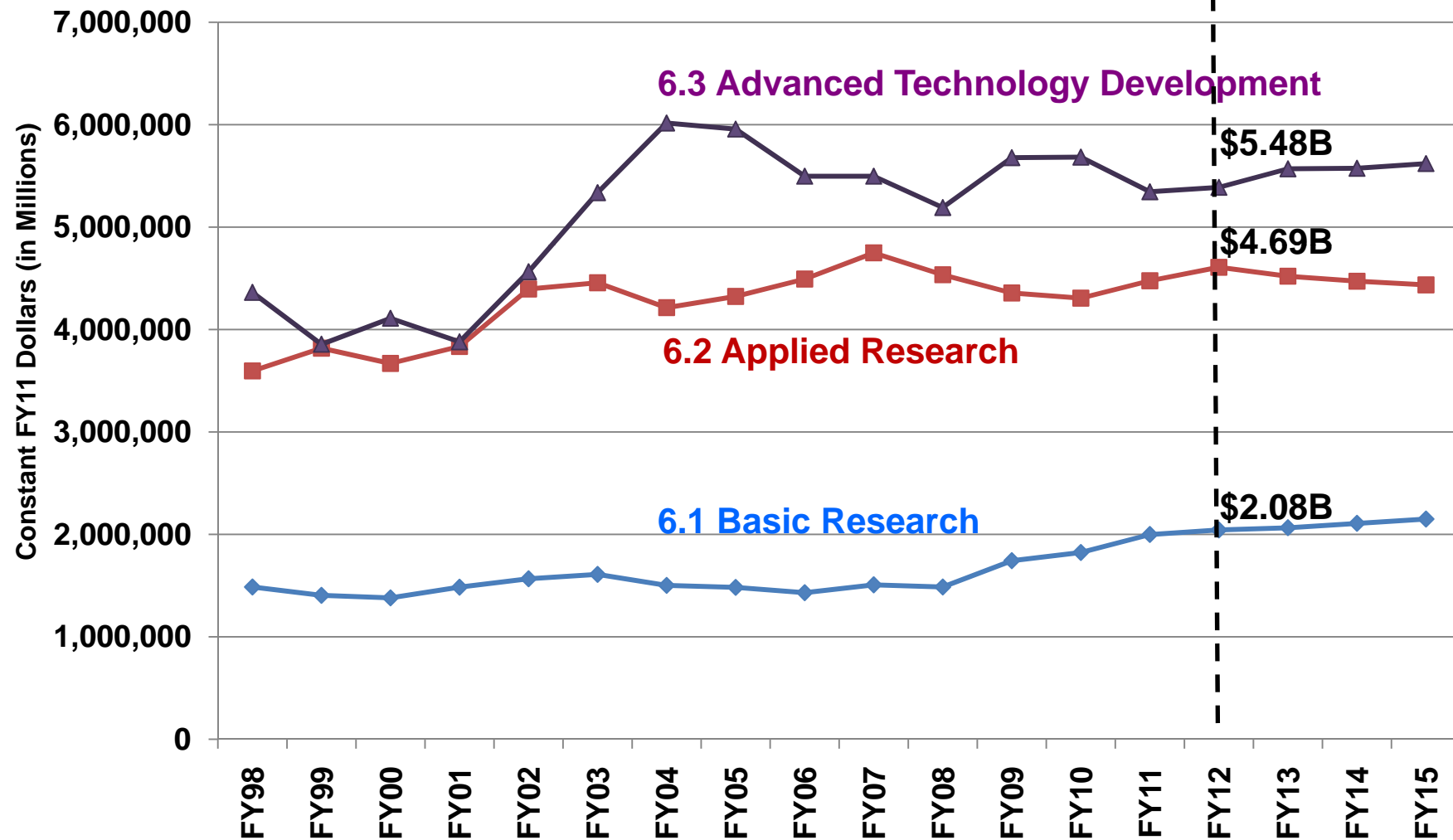


DoD S&T Funding By Budget Activity



- President's Budget Requests – in Constant FY11 Dollars -

Total FY12 S&T request = \$12.25B





Integrated S&T Enterprise

Missions

- National Defense Strategy
- Quadrennial Defense Review
- Space Posture Review
- Nuclear Posture Review

Objective Architectures

Operational Challenge

JUONs, UONs, COCOM
IPL

Critical Capabilities

Enabling Technologies

Laboratory Program

Basic Research Program

STEM Program

Industry IR&D



S&T Executive Committee (EXCOM)



Lt Gen Larry Spencer
J8



Ms. Kathleen Hicks
DUSD(SPF)



Mr. Zach Lemnios
ASD(R&E)



Mr. Andrew Weber
ASD(NCB)



Mr. Brett Lambert
DASD(MIBP)



Dr. Regina Dugan
DARPA



Dr. Steven Walker
DASAF(STE)



Dr. Marilyn Freeman
SAAL-ZT



RADM Nevin Carr
CNR



Conference Summary



- **FY2012 President's Budget Request**
- **ASD(R&E) Programs**
 - Basic Research
 - Rapid Fielding
 - Test & Evaluation
 - Trusted Foundry
- **Department S&T Emphasis Areas**
- **Components' S&T Program Overviews**
- **Combatant Command Briefs**



High Velocity Penetrating Weapon Program Overview

13 Apr 2011

***Leo Rose, AFRL/RW
Program Manager
850-883-2188***

Distribution A: Approved for public release; distribution unlimited

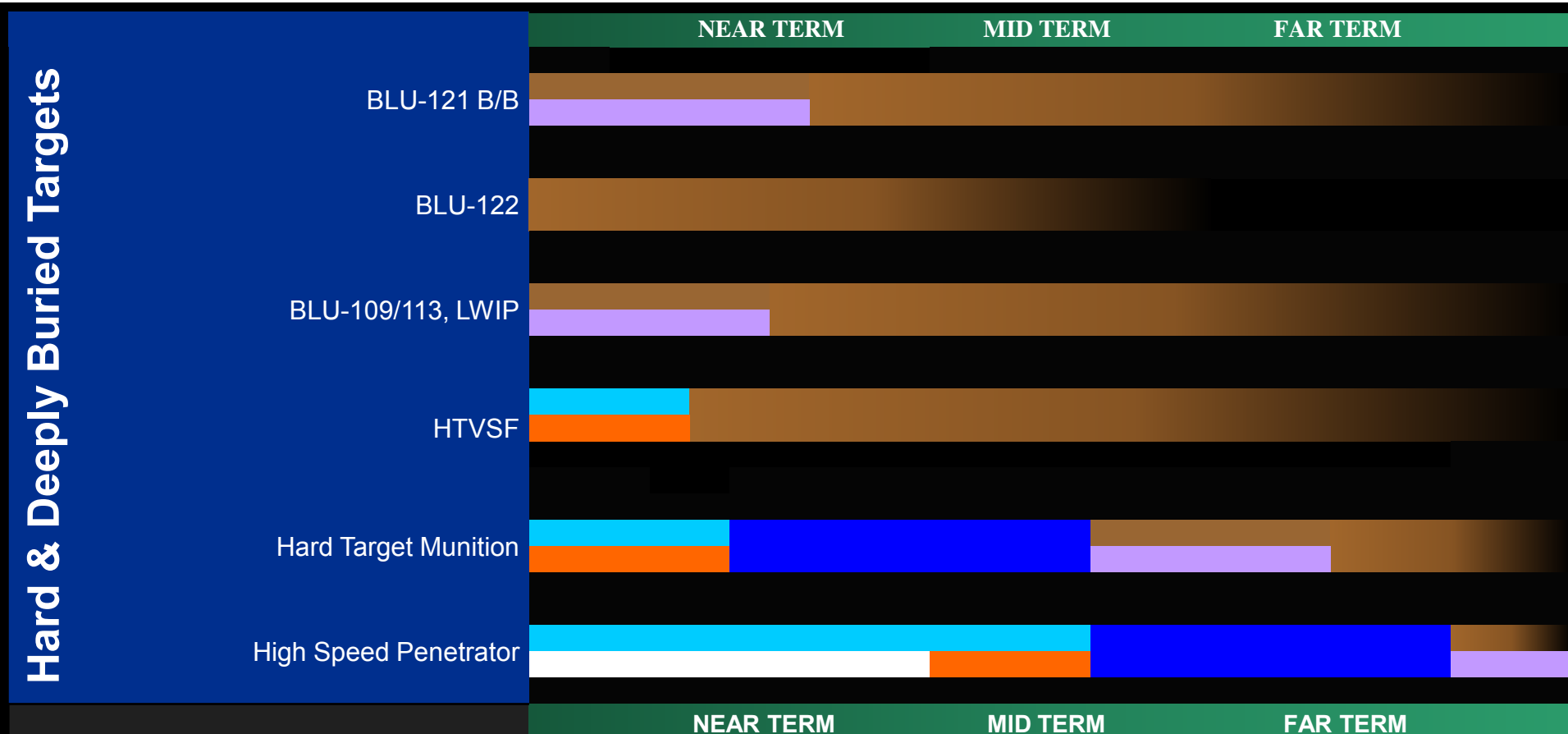


HDBT Weapons Roadmap

(Notional)



U.S. AIR FORCE





High Velocity Penetrating Weapon (HVPW)



U.S. AIR FORCE

AFRL RW / RZ / RY / RI

Program Schedule (FY)

As of: 3 Feb 11

10 11 12 13 14 15

Establish Requirements

Modeling & Simulation

Ordnance Package

Propulsion

Guidance Nav & Control (GN&C)

Systems Eng / Integration

Test & Evaluation

Tech Availability Dates

Description

Provides improved penetration capability of hard, deep targets with boosted impact

Technology

- Survivable ordnance package
- GN&C (precision navigation, terminal flight control)
- Propulsion (performance, GN&C interactions, IM)

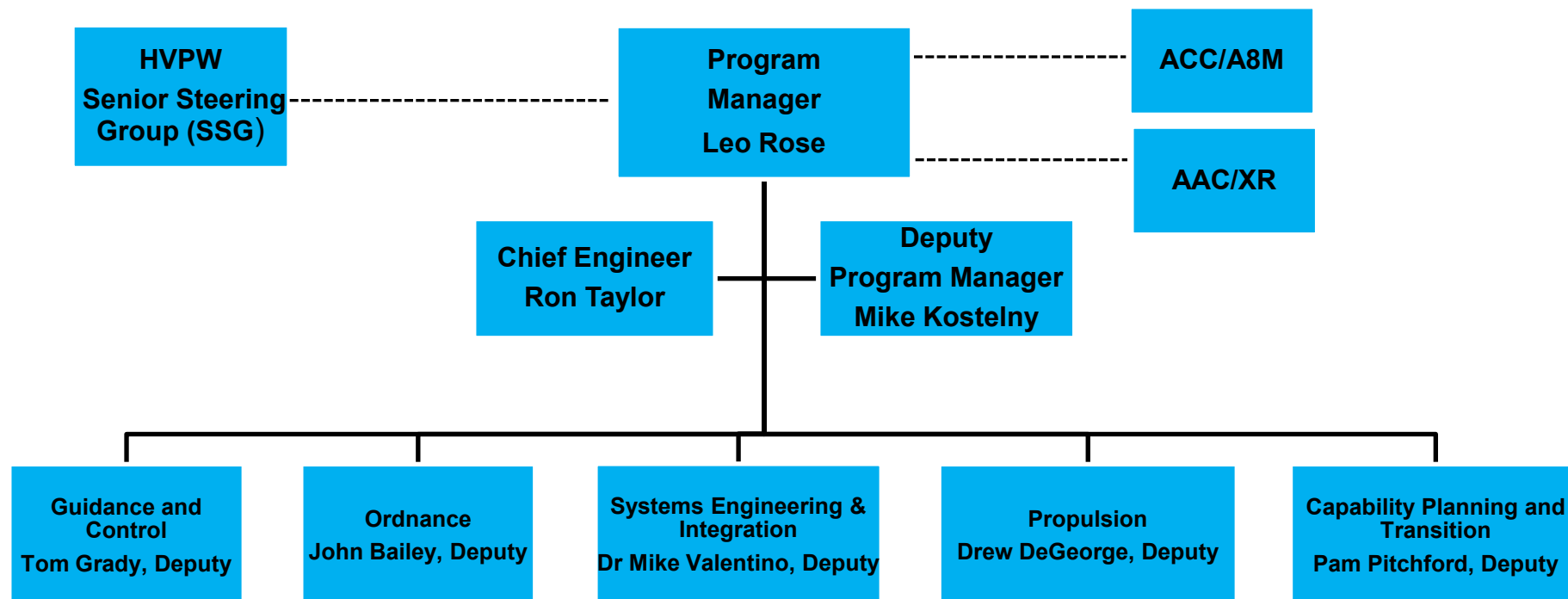
Benefits to the War Fighter

- Defeats emerging hard targets
- 2000 lb weapon
- Internal carriage on F-35
- Increased loadout for other bomber/fighters



U.S. AIR FORCE

High Velocity Penetrating Weapon Team

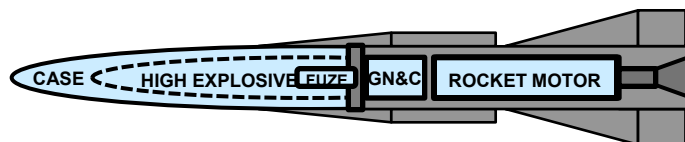




High Velocity Penetrating Weapon Sys Engineering & Flight Vehicle Integration



Systems Engineering & Flight Vehicle Integration



- **Flight Vehicle Integration**
 - Subsystem requirements, specs, models for subsystem trades, M&S
 - System trades of GN&C, warhead/fuze, and airframe/propulsion
 - Initial Technology Demonstration flight test vehicle concept development
- **Aircraft Integration, Carriage & Release**
 - F-35 internal carriage
 - Platform electrical and physical constraints



Flight Vehicle Integration Major Technical Challenges



- Focus on *integration* issues associated with terminal accuracy and vehicle orientation
 - Airframe / control surfaces
 - GN&C algorithms
 - Booster misalignment, shock & vibration
- Scope of effort varies dramatically depending on desired TRL
 - AFRL/RW effort will end at subcomponent demonstrations not integrated flight test
 - AAC/XR CCTDs will provide initial trade space



HVPM Integration with F-35

U.S. AIR FORCE

- **F-35 physical fit requirement**
 - F-35 physical fit requirement will be validated to a “stay within volume”
- **Bay Acoustics and Temperature Issues**
 - Goal is to use standard design practices as those of current systems
- **Bomb Rack, Launcher**
 - Goal is to use current F-35 equipment (e.g. BRU-68)
 - 1760 / 1553 Weapon-Store Interface/Data Bus
 - Some electrical and message content changes as typical with new weapons
- **Ground Handling Equipment (e.g. loaders)**
 - Goal is to design to current systems; minimize use of adaptors

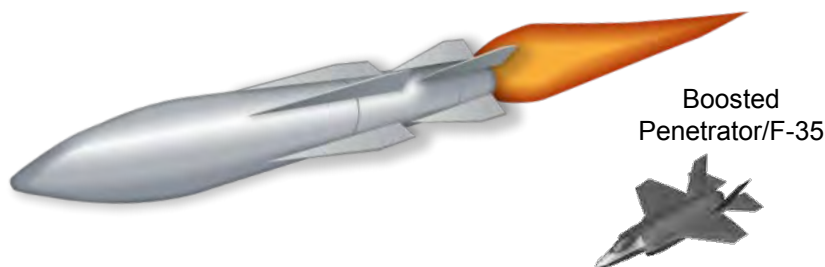


High Velocity Penetrating Weapon Ordnance Package



U.S. AIR FORCE

Conventional Survivable Ordnance Package (CSOP)

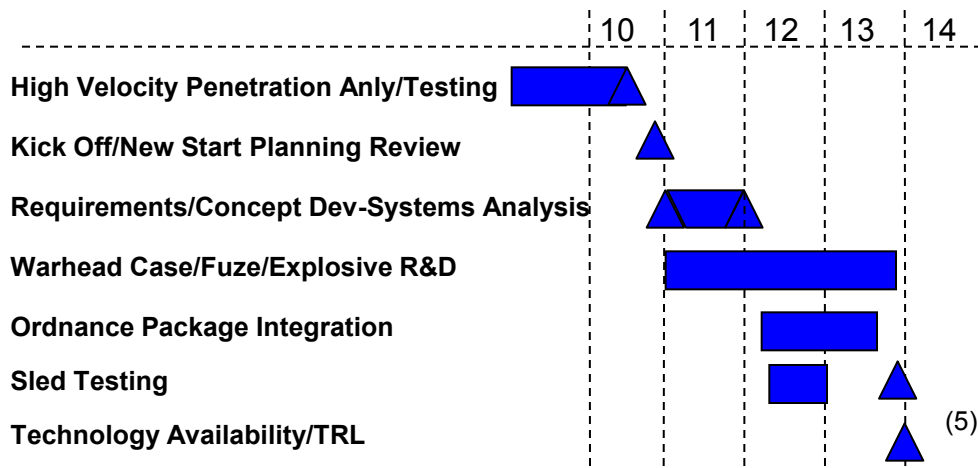
Boosted
Penetrator/F-35

*Survivable
explosive payload*

*Miniaturized,
survivable,
intelligent fuzing*



Technology Investment Schedule (FY)



Description	Benefits to the Warfighter
Warhead that survives and functions after a boosted impact into hard target	<ul style="list-style-type: none"> • Penetrating weapon capability for F-35 in a 2000 lb class weapon
Technology	
<ul style="list-style-type: none"> • Survivable intelligent-fuze technology • Survivable energetic explosive • Survivable warhead case • Modeling & Simulation Tools – Penetration mechanics, lethality & material characterization • Leverage ongoing R&D 	<ul style="list-style-type: none"> • Increased reliability with innovative fuze design which allows for redundancy • Safer munitions through improved high explosive development



Fuze Technology

U.S. AIR FORCE

- **Hardened Miniature Fuze Technology (HMFT) Post Impact Module**
 - Successfully demonstrated survivability and post impact burst point system functionality
 - Very High G (VHG) and airgun shock test environments



Laboratory-VHG Test



Laboratory-Airgun Test

- **Task added to existing HMFT Contract for FY11 HMFT Feasibility Study for CSOP**
 - Conduct contractor laboratory testing
 - Mechanical design updates
 - Assess and document HMFT axial/lateral shock survivability in cannon tests
- **HMFT Feasibility study & analysis**
 - Requirements evaluation (signal, power, communications, arming)
 - Interfaces
 - Mechanical packaging & mounting



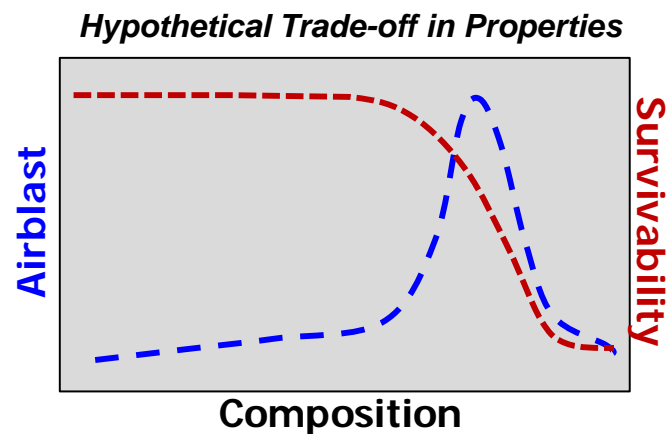
Explosive

New Development

U.S. AIR FORCE

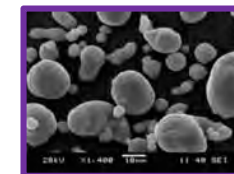
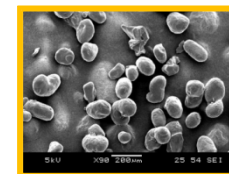
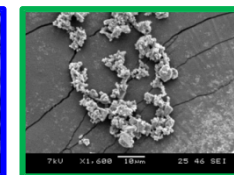
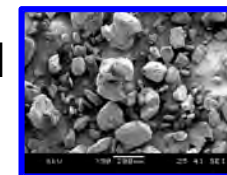
Approach

- Map out the formulation design space via systematic “Mixture Design” methodology
 - A type of statistical, “Design of Experiments”
- Quantify the tradeoff in design parameters
 - Airblast, sensitivity – survivability, & mechanical properties
- Apply residual knowledge
 - Validation data for theory and M&S
 - Reduce formulation time for future application requirements
 - Identify the range of possibilities for current ingredients



Progress

- Ingredients selected, all existing with MIL-SPEC's
- Composition limit inputs found – 45 run matrix generated
 - Mixture viscosity was primary constraint
- Gathered extensive laboratory-scale safety test data





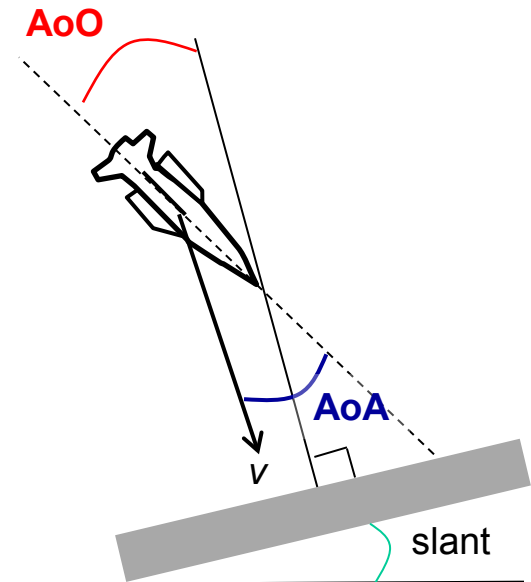
High Velocity Penetrating Weapon Guidance Research S&T Plan



Control

U.S. AIR FORCE

- **Boosting with a rocket adds some issues:**
 - Motor/thrust misalignment
 - Control authority, especially with oblique trajectories (e.g. slant targets)
 - Vibration / acceleration effects
- **HVPW could have significant problems during boost**
 - Angle of Obliquity (AoO) – could be unknown
 - Angle of Attack (AoA) – interacts with AoO
- **Must control closely to ensure:**
 - Maximum penetration
 - Fuze survives impact





U.S. AIR FORCE



Risk Assessment

Largest risk / least maturity in following component areas:

- **CEP control**
- **Angle of Attack (AoA) sensing & control**
- **Trajectory shaping for optimized rocket firing**
- **Rocket integrated control**

Philosophy: methodical modeling and tool-up to:

1. **Show maturity of guidance subsystem**
2. **Prepare for more than one MS-A contractor conceptual design**



High Velocity Penetrating Weapon Propulsion



HVPW Propulsion

U.S. AIR FORCE

- **HVPW derived operational systems will require a new rocket motor**
- **HVPW propulsion potential design/technology challenges include**
 - **Thrust alignment/alignment control**
 - **Energy management**
 - **Tight propellant burn rate specification**
 - **Increased performance**
 - **Wrap-around motor**
 - **Service life through extreme environments**



Questions

***Leo Rose, GS-15
AFRL/RW***

***HVPW Program Manager
ROSEL@EGLIN.AF.MIL
850-883-2188***



The DoD T&E/S&T Program

George Rumford
Program Manager

**Test Resource Management Center
Test & Evaluation / Science & Technology Program
(TRMC, T&E/S&T)**

NDIA 12TH Annual Science & Engineering Technology Conference



Test Resource Management Center (TRMC)



- **DoD Field Activity**
- **Direct Report to USD(AT&L)**

☆☆☆ SES Director

Oversee Test Infrastructure

Major Range & Test Facility
Base (MRTFB)
Other T&E Facilities
Within & Outside DoD

Develop T&E Strategic Plan

Biennial 10-Year
Strategic Plan for
DoD T&E Resources

Administer Corporate T&E Investment Programs

Centrally-Funded T&E
Investment Programs
(T&E/S&T, CTEIP, JMETC)

Certify T&E Budgets

Annual Certification of
Military Departments &
Defense Agencies T&E
Budgets



The STEWARD of the DoD Test Infrastructure

Major Range and Test Facility Base (MRTFB): The “Critical Core”

24 Sites: Army-9; Navy-6; Air Force-7; Defense Agency-2

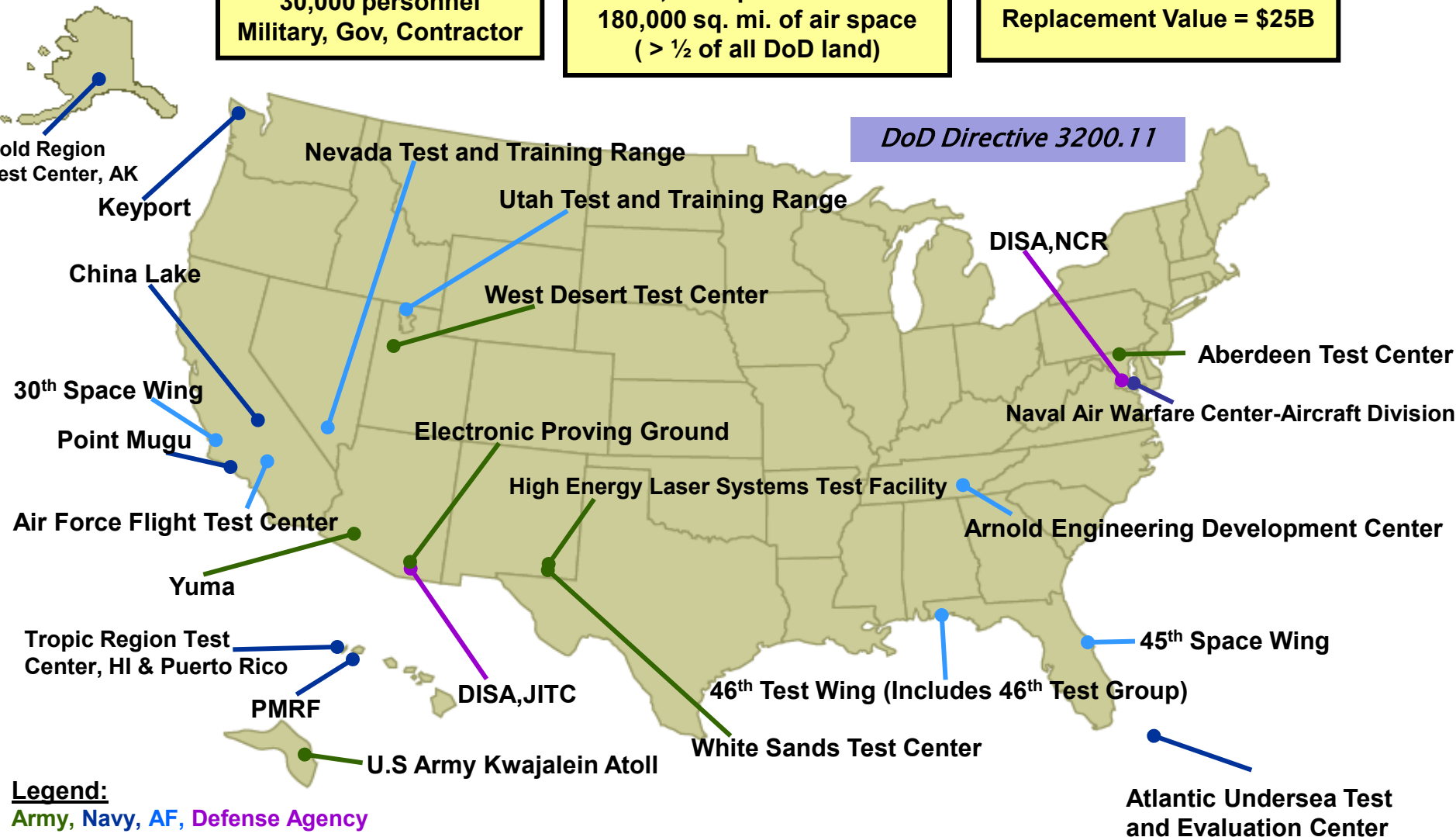


30,000 personnel
Military, Gov, Contractor

18,000 sq. mi. of land
180,000 sq. mi. of air space
(> ½ of all DoD land)

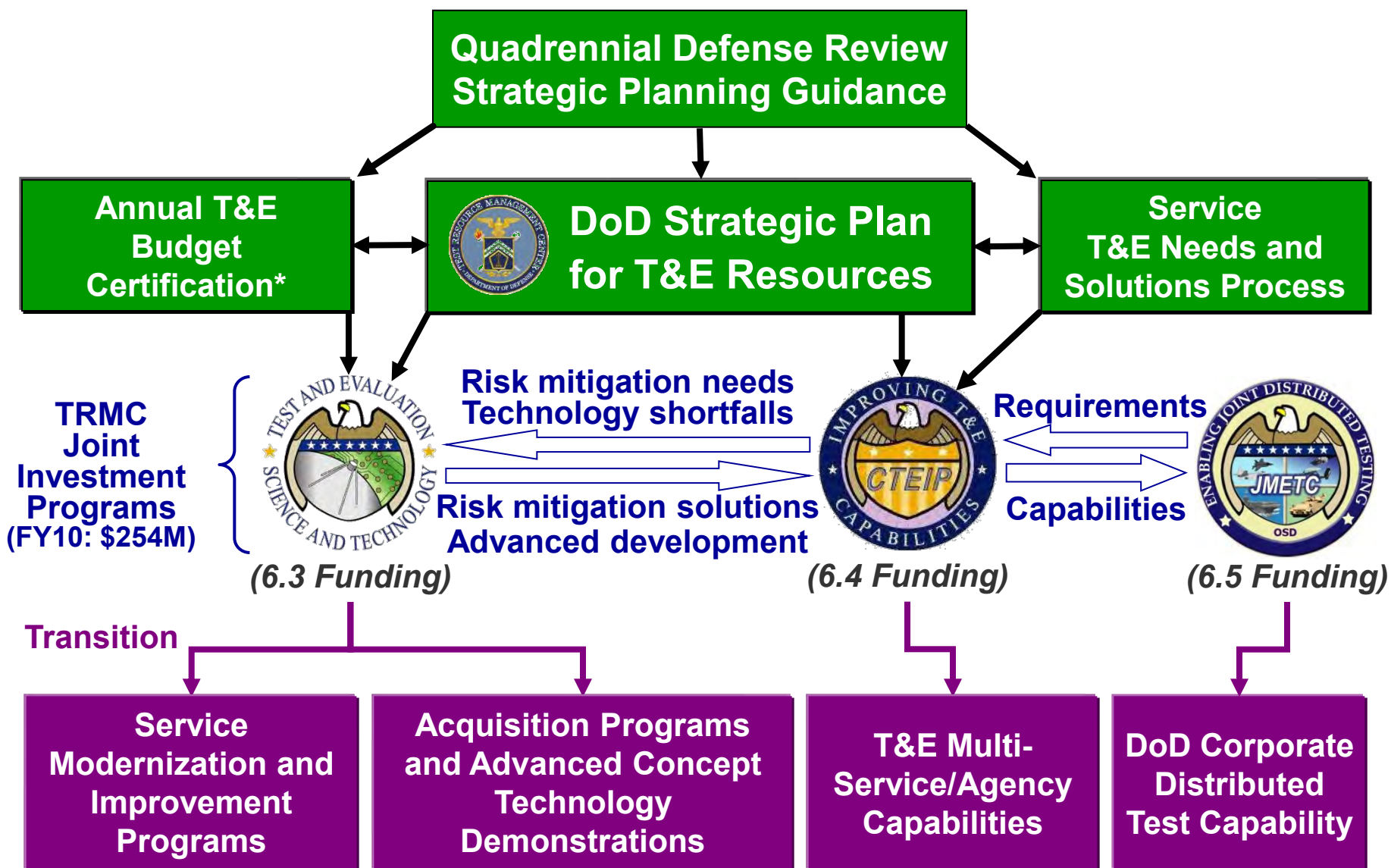
Replacement Value = \$25B

DoD Directive 3200.11





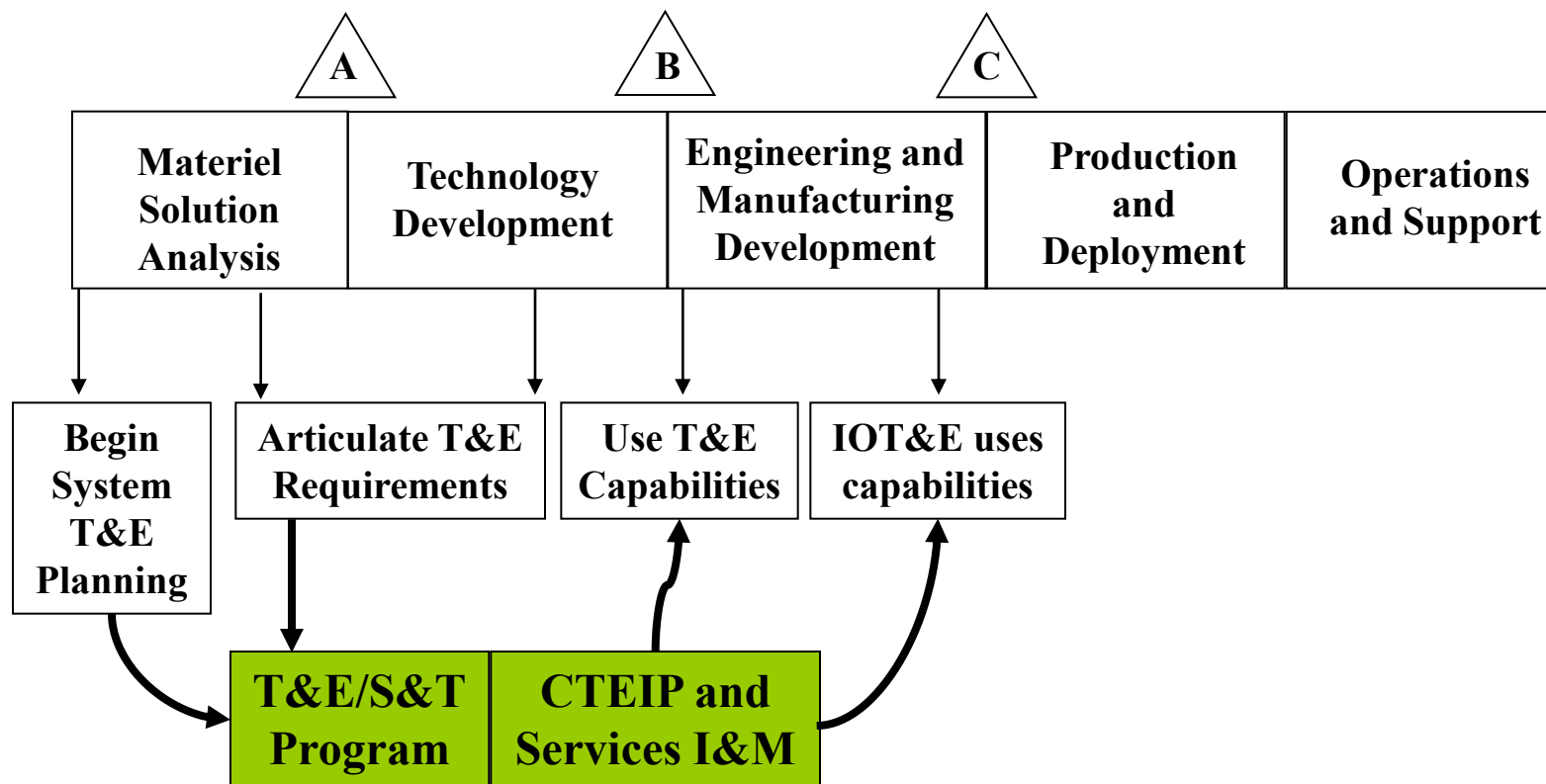
Synergy through Aligned Investment





T&E Capability Development Cycle

Challenge: T&E Capabilities are available in time to provide useful insight to decision-makers and warfighters



Cycle for Test Capability Development Must Begin Early



T&E/S&T Program Overview



Mission: Develop Technologies Required to Test Future Warfighting Capabilities

- Established in FY02
 - Joint DDR&E / DOT&E Initiative
 - Transitioned to TRMC in FY05
- RDT&E Budget Activity 3 funds
- Purpose
 - High Risk / High Payoff R&D for Testing
 - Foster technology transition to major DoD test ranges
 - Risk reduction for test capabilities developments

92 Active Projects

- Annual Broad Agency Announcements (BAAs)
 - Academia
 - Industry
 - Government Laboratories
- Tri-Service working groups
 - Validate requirements
 - Evaluate proposals
 - Facilitate technology transition
- Central Oversight – Distributed Execution

As of 15 April 2011

Seven Test Technology Areas

Advanced Propulsion
18 Active Projects

Unmanned & Autonomous Systems
5 Active Projects

Advanced Instrumentation
6 Active Projects

Directed Energy
22 Active Projects

Spectrum Efficiencies
13 Active Projects

Multi-Spectral Sensors
16 Active Projects

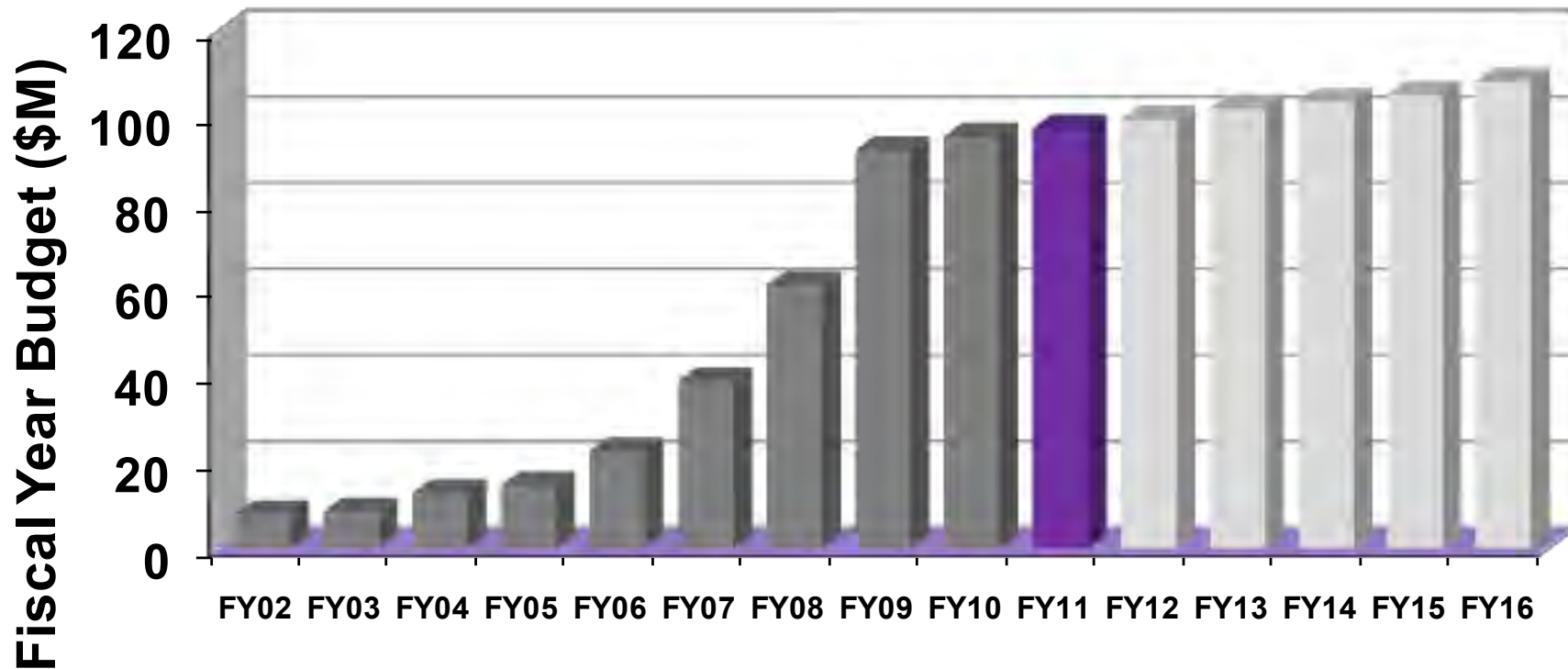
Net-Centric Systems
12 Active Projects

FY 2010	FY 2011	FY 2012	FY 2013	FY 2014	FY 2015	FY 2016
\$95.7M	\$97.6M	\$99.6M	\$102.2M	\$103.7M	\$105.4M	\$108.4M

Shaping Technology into Tomorrow's T&E Capabilities



T&E/S&T Program Annual Budget Historical (FY02) to Future Projection (FY16)





Top DoD S&T Priorities

- SECDEF memo dated 19 April 2011
- Seven priority DoD S&T investment areas
 - 1) Data to Decisions
 - 2) Engineered Resilient Systems
 - 3) Cyber Science and Technology
 - 4) Electronic Warfare / Electronic Protection
 - 5) Counter Weapons of Mass Destruction
 - 6) Autonomy
 - 7) Human Systems

What will we need to TEST these technologies?



T&E/S&T Program Overview



Mission: Develop Technologies Required to Test Future Warfighting Capabilities

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 - Joint DDR&E / DOT&E Initiative
 - Transitioned to TRMC in FY05
- RDT&E Budget Activity 3 funds
- Purpose
 - High Risk / High Payoff R&D for Testing
 - Foster technology transition to major DoD test ranges
 - Risk reduction for test capabilities developments

112 Active Projects

- Annual Broad Agency Announcements (BAAs)
 - Academia
 - Industry
 - Government Laboratories
- Tri-Service working groups
 - Validate requirements
 - Evaluate proposals
 - Facilitate technology transition
- Central Oversight – Distributed Execution

As of 6 June 2011

Nine Test Technology Areas

Advanced Propulsion
18 Active Projects

Unmanned & Autonomous Systems ⁺³
8 Active Projects

Advanced Instrumentation ⁺⁵
11 Active Projects

Multi-Spectral Sensors ⁺¹
17 Active Projects

Directed Energy ⁺⁵
26 Active Projects ₋₁

Spectrum Efficiency ⁺⁶
19 Active Projects

Net-Centric Systems ⁺¹
13 Active Projects

Electronic Warfare
Re-aligning 6 projects from Multi-Spectral

Cyber Test
Re-aligning 2 projects from Net-Centric

FY 2010	FY 2011	FY 2012	FY 2013	FY 2014	FY 2015	FY 2016
\$95.7M	\$97.6M	\$99.6M	\$102.2M	\$103.7M	\$105.4M	\$108.4M

Shaping Technology into Tomorrow's T&E Capabilities



T&E/S&T Program

Test Technology Areas



Test Technologies for:

- **Enhanced Test Capabilities**
 - Advanced Instrumentation Systems
 - Spectrum Efficient Technology
- **Emerging Warfighting Capabilities**
 - Directed Energy Weapons
 - Hypersonic Vehicles
 - Multi-Spectral/Hyperspectral Sensors
 - Net-Centric Warfare Systems
 - Unmanned and Autonomous Systems
 - **Electronic Warfare Systems**
 - **Cyber Operations**

**112 Active
Projects**

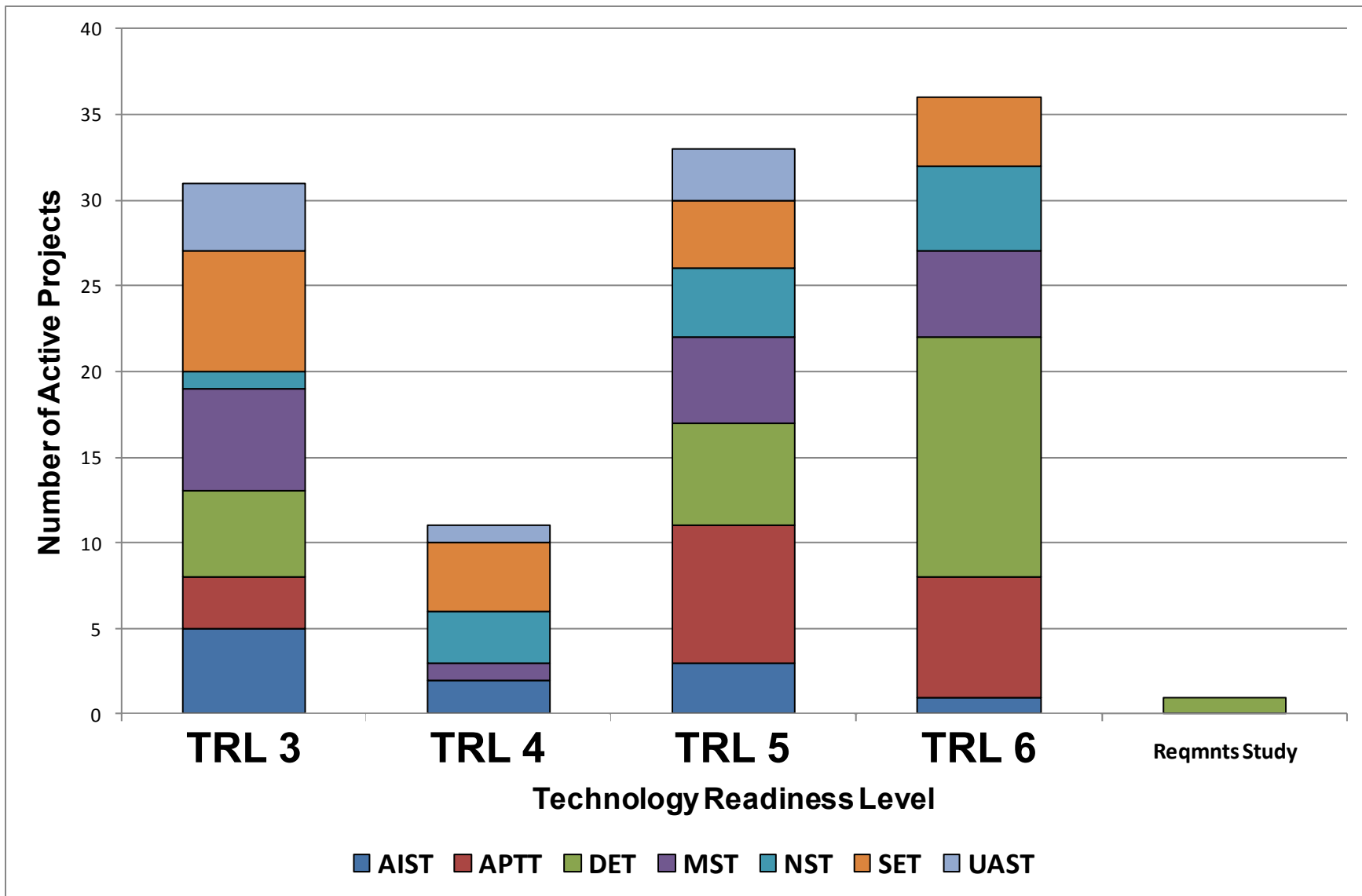
New Test Technology Areas

***Each Test Technology Area has a Tri-Service
Working Group with T&E and S&T participants***



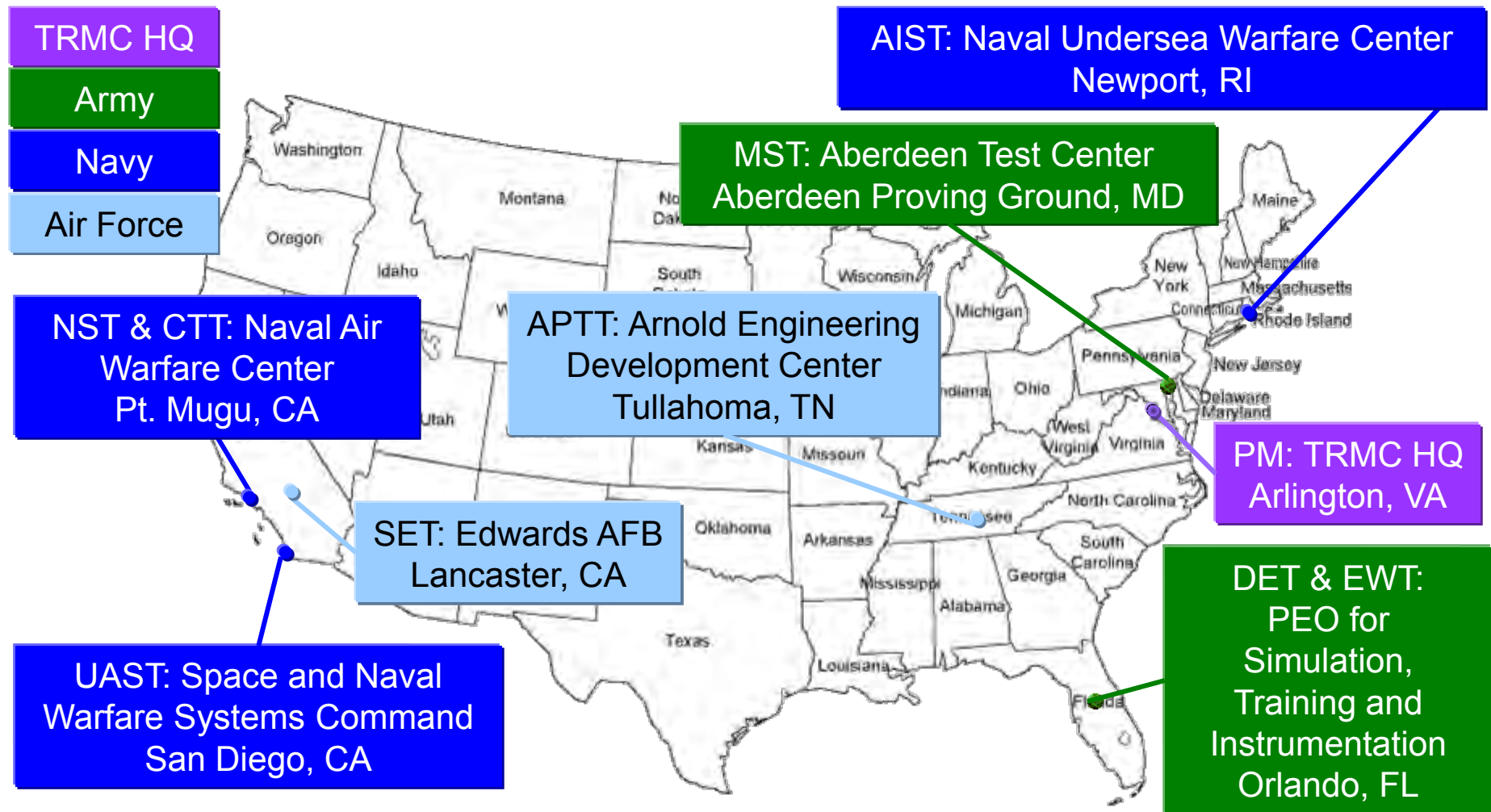
Technology Maturity by TTA

(Current T&E/S&T Portfolio of 112 Active Projects)





T&E/S&T Executing Agents



Central Oversight – Distributed Execution



T&E/S&T Executing Agents



- Army**
 - **Minh Vuong, Army PEO-STRI**
 - Directed Energy Test (DET)
 - Electronic Warfare Test (EWT)
 - **Frank Carlen, Army Aberdeen Test Center**
 - Multi-Spectral Test (MST)
- Air Force**
 - **Ed Tucker, Air Force AEDC**
 - Advanced Propulsion Test (APTT)
 - **Tom Young, Air Force AFFTC**
 - Spectrum Efficiency Technology (SET)
- Navy**
 - **Gil Torres, Navy NAVAIR (Pt. Mugu)**
 - Net-Centric Systems Test (NST)
 - Cyber Test Technologies (CTT)
 - **George Shoemaker, Navy NUWC (Newport)**
 - Advanced Instrumentation Systems (AIST)
 - **Steve Koepenick, Navy SPAWAR**
 - Unmanned and Autonomous Systems Test (UAST)



T&E/S&T Program Industry / Academia Days 2011



- **18-20 October 2011 in Atlanta, GA**
 - Overview of the T&E/S&T Program
 - Overview of all Nine (9) Test Technology Areas
 - Preview of the T&E/S&T Broad Agency Announcement topics
 - Contracting and proposal requirements
 - Individual meetings with the T&E/S&T Program Manager and Test Technology Area Executing Agents

To request future announcements:

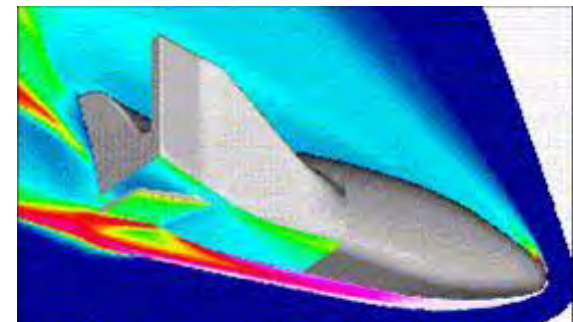
www.trmc-test.org/i-a_days



Determining Position of a System Under Test without Using GPS



- **Emerging challenges for Time-Space-Position Information (TSPI) instrumentation**
 - Test operations in GPS-denied environments (urban, caves, dense foliage, undersea)
 - Hypersonic vehicles in a plasma field
 - Micro autonomous systems
 - Large-scale System-of-Systems environments
 - Low Observable (LO) Systems that can not mount external instrumentation





Improving Testing of Undersea Systems in a Realistic Operational Environment



Needs: Provide submarine undersea tracking during test events - without sub needing to ping!

DARPA-developed chip scale atomic clock

Key issues: Maintain clock accuracy, operate week+ without update



Insertion into undersea pingers



Highly accurate track is displayed in real-time on board the tracked submarine

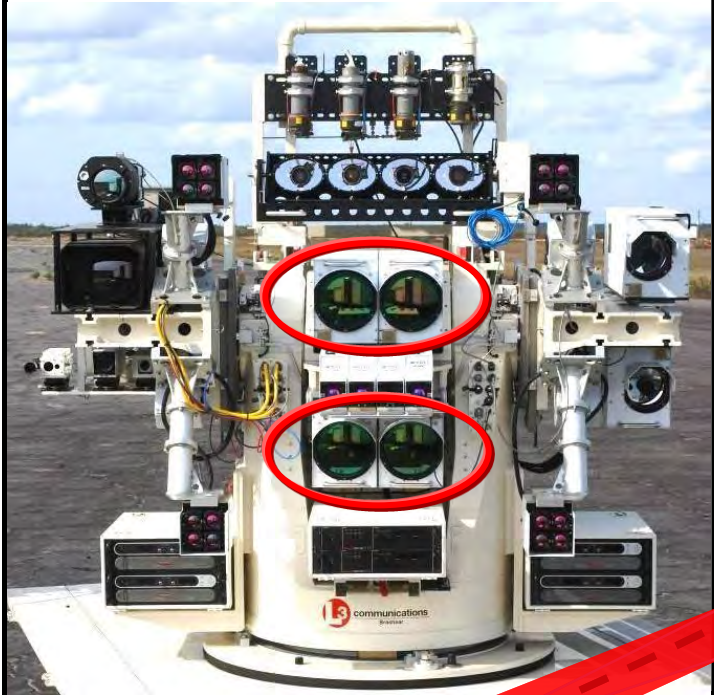
T&E/S&T – CTEIP transfer: Providing critical test needs, validate crucial warfighting systems

OT for Common Broadband Advanced Sonar System (CBASS) Torpedo



Improving Testing of IRCM Systems

JMITS “paints” UV & IR signatures on IRCM systems and characterizes laser and flare countermeasures



Both Units Delivered Directly to Test

Eglin AFB (DoN LAIRCM Testing on Navy CH-46)

China Lake (LAIRCM Testing on AFSOC CV-22)

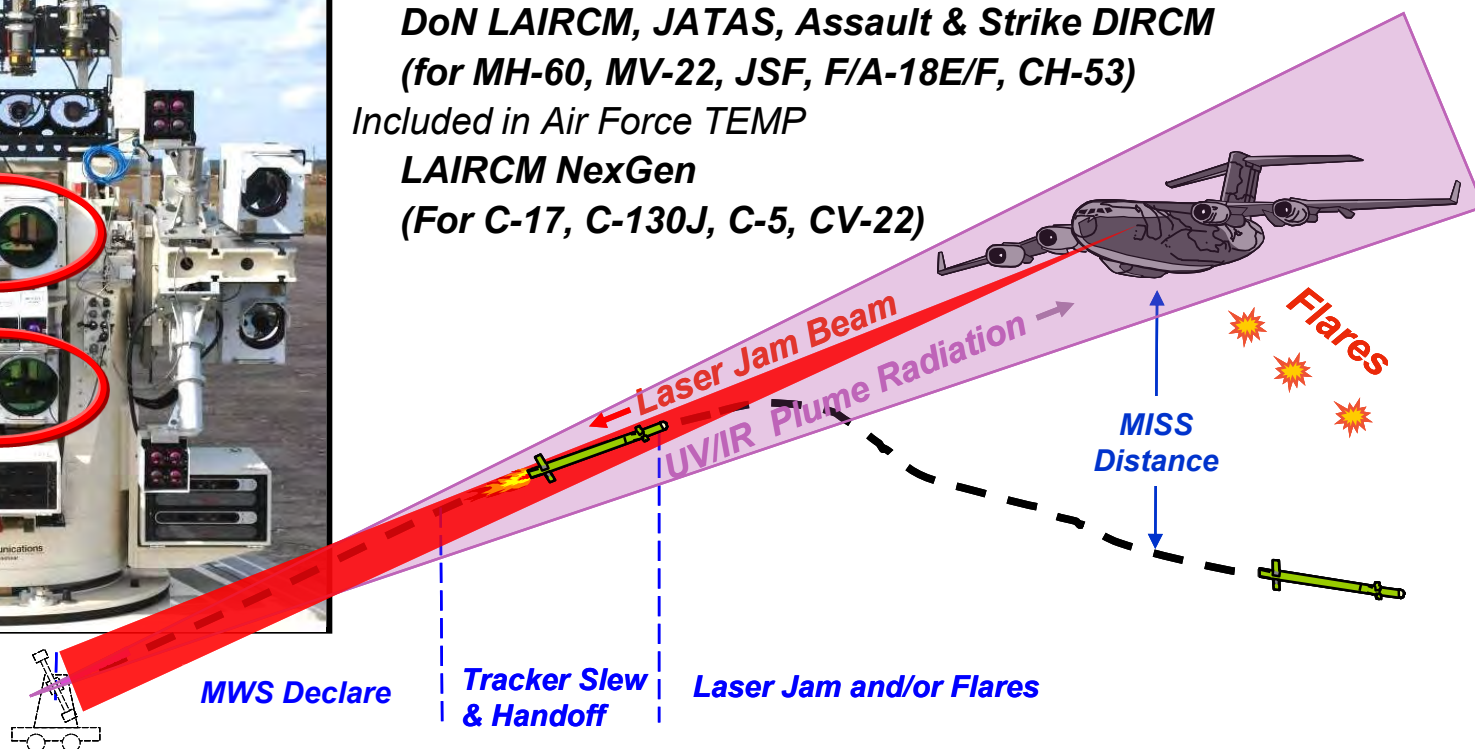
Included in Navy TEMP

***DoN LAIRCM, JATAS, Assault & Strike DIRCM
(for MH-60, MV-22, JSF, F/A-18E/F, CH-53)***

Included in Air Force TEMP

LAIRCM NexGen

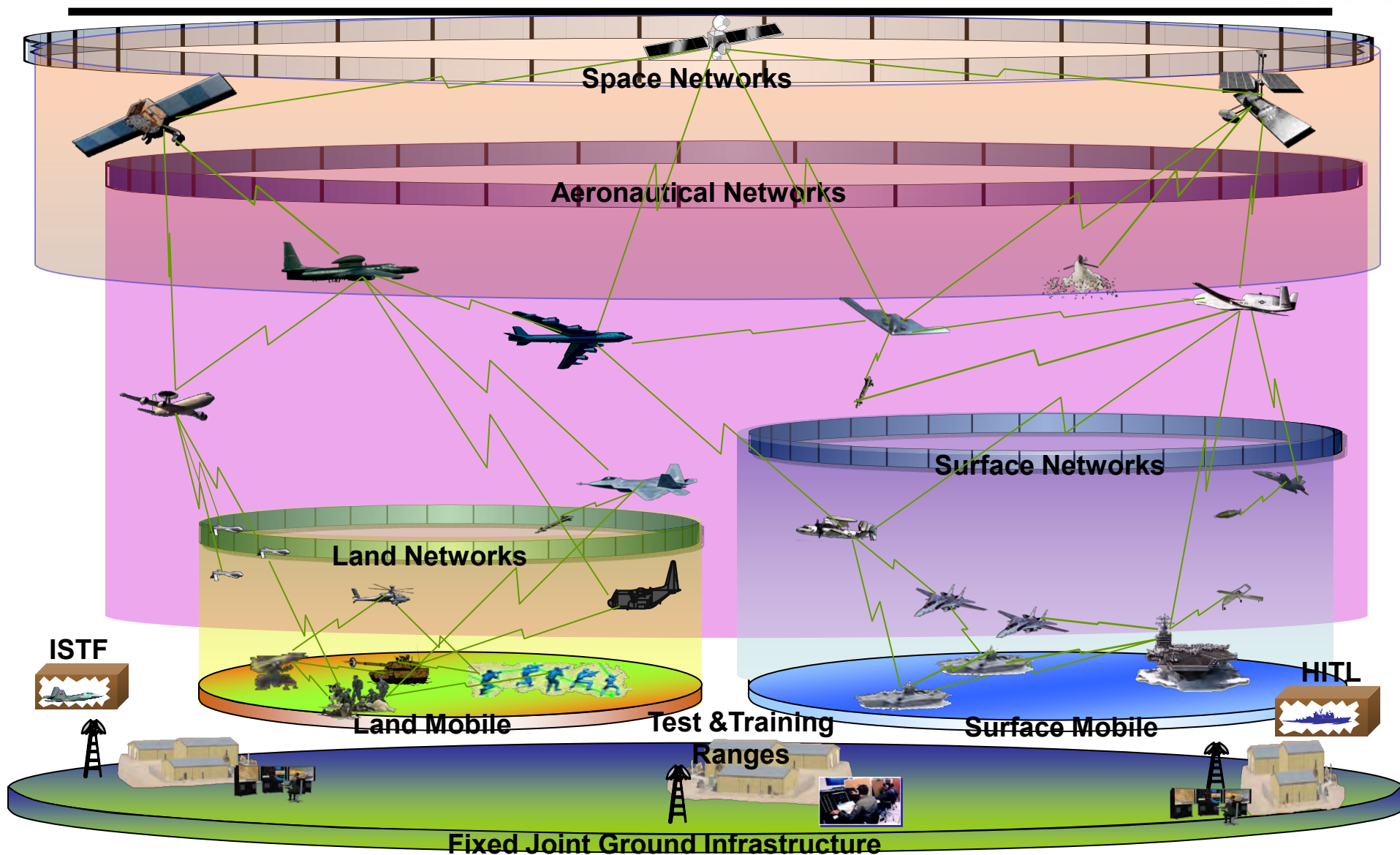
(For C-17, C-130J, C-5, CV-22)



Required T&E/S&T Development for Higher Power Continuous Wave Infrared Sources

- To simulate long range shots within MANPAD operational envelopes
- To simulate longer range RF SAMs during multi-spectral testing (RF & IR)
- Two Colors (IR-Red & IR-Blue)

Improving Real-time Data Throughput Across the Test Environment





T&E/S&T Program Project Selection Process

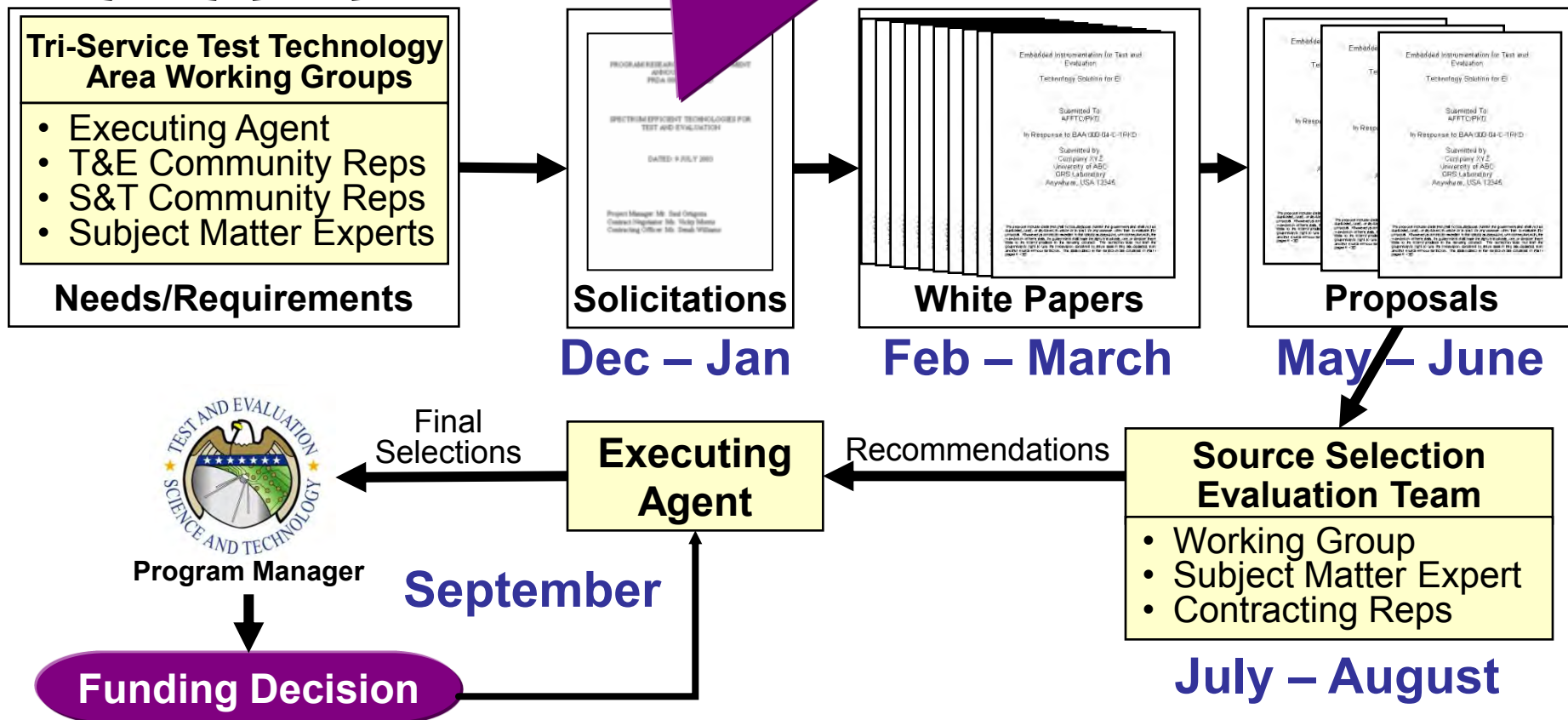


Drivers



<http://www.fedbizopps.gov/> → Search for —TRMC—

Solicitations are issued through
<http://www.fedbizopps.gov>





The Proposal — Key Criteria



- **Meets a T&E Need**
- **Requires S&T work**
- **High Payoff**
- **Broad application (more than one DoD test activity)**
- **High potential for transition to development of a test capability**



T&E/S&T Program Summary



- **T&E/S&T Program initiated to address critical T&E needs tied to S&T drivers**
 - Advancing the state of the art in T&E technologies
- **The only DoD S&T program dedicated to T&E**
- **Annual Call to Industry, Academia, and Government Laboratories to address test capability needs**
- **Competitive technology developments to get the best technologies possible to the test community**
- **Focused on transition into needed test capabilities**

Looking Ahead, Responsive, and Agile



Questions?

**Please stop by our booth in
the exhibit hall**

Contact Information:

Mr. George Rumford

**Test Resource Management Center
T&E / S&T Program**

George.Rumford@osd.mil

United States Special Operations Command



Science and Technology Capabilities to the SOF Operator

**Ms. Lisa Sanders
Deputy Director,
Science and Technology
Directorate (SORDAC-ST)
June 2011**

Our World Has Changed...



“Our strategic focus has shifted largely to the south... certainly within the special operations community, as we deal with the emerging threats from the places where the lights aren't....”

ADM Eric T. Olson



Commander's Guidance & Direction for USSOCOM S&T / S&T Vision

- **Develop a coherent capability-based research and development effort focused on placing new capabilities in the hands of SOF operators**
- **Conduct technology discovery, coordinate research and development activities, rapidly integrate technology developments, and rapidly insert new capabilities for equipment and techniques across the force**

A Special Operations force, empowered with the newest technologies and capabilities, able to operate in any environment, work effectively with partners, and defeat all adversaries



USSOCOM

S&T Integrated Priority List (STIPL)

- STIPLs focus on SOCOM S&T needs while complementing the SOCOM IPL
- FY13-17 S&T Priorities (Not in Order)
 - Extended duration incapacitation
 - Comprehensive signature management across electromagnetic spectrum
 - Understand and Exploit the Battlefield
 - “Own the Night”



S&T Funding Sources

■ Two Traditional Sources:

➤ BA2 (Special Operations Technology Development)

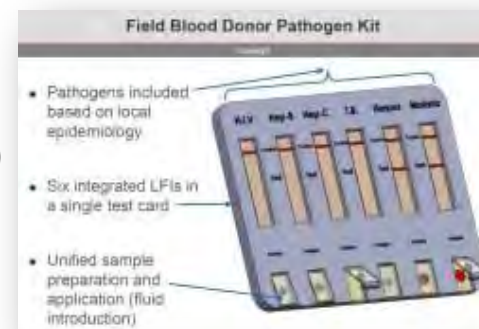
- TRL 3-5
- Studies, early lab hardware, software development models

➤ BA3 (Special Operations Special Technology)

- TRL 5-7
- Prototypes, Demonstrations

■ Rapid Exploitation of Innovative Technologies for SOF (REITS)

- Developmental Effort with potential to transition to field in 6-12 months (no more than 18 months)
- High Risk, High Payoff Projects





Funding Sources (Cont)

■ Small Business Innovative Research

- Phase 1: Competitively Awarded Topics, \$100k for feasibility studies
- Phase 2: Sole Source to Phase 1 contractors, approx \$1M per contractor
- Phase 3: Sole Source, Requires Program Funds, no \$ limit

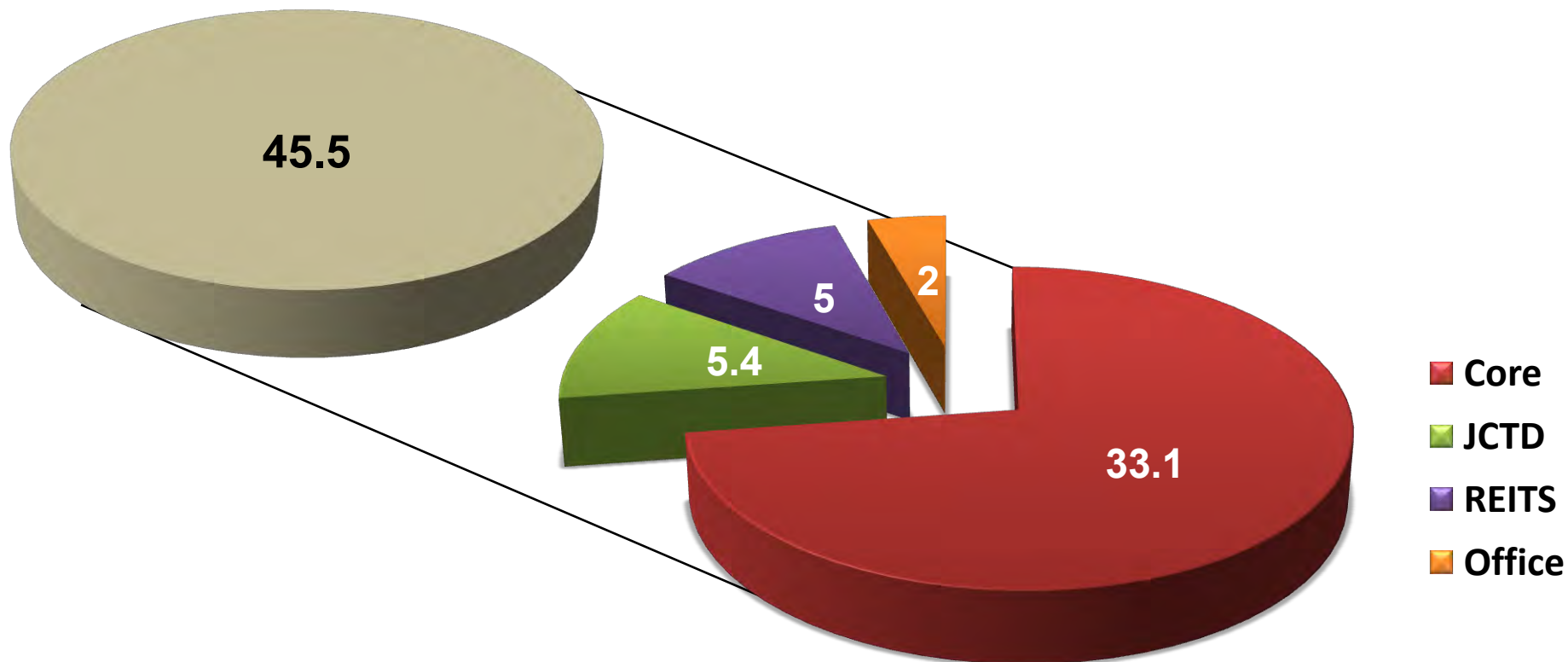


■ Leveraging

- OSD, Service Research Labs, DARPA, Dept of Energy, OGA



FY2011 S&T Funding (\$M)





USSOCOM

S&T Commodity Alignment

■ Four Primary Commodities

- Soldier Systems
- Mobility & Classified
- RF & Antennas
- Power & Energy

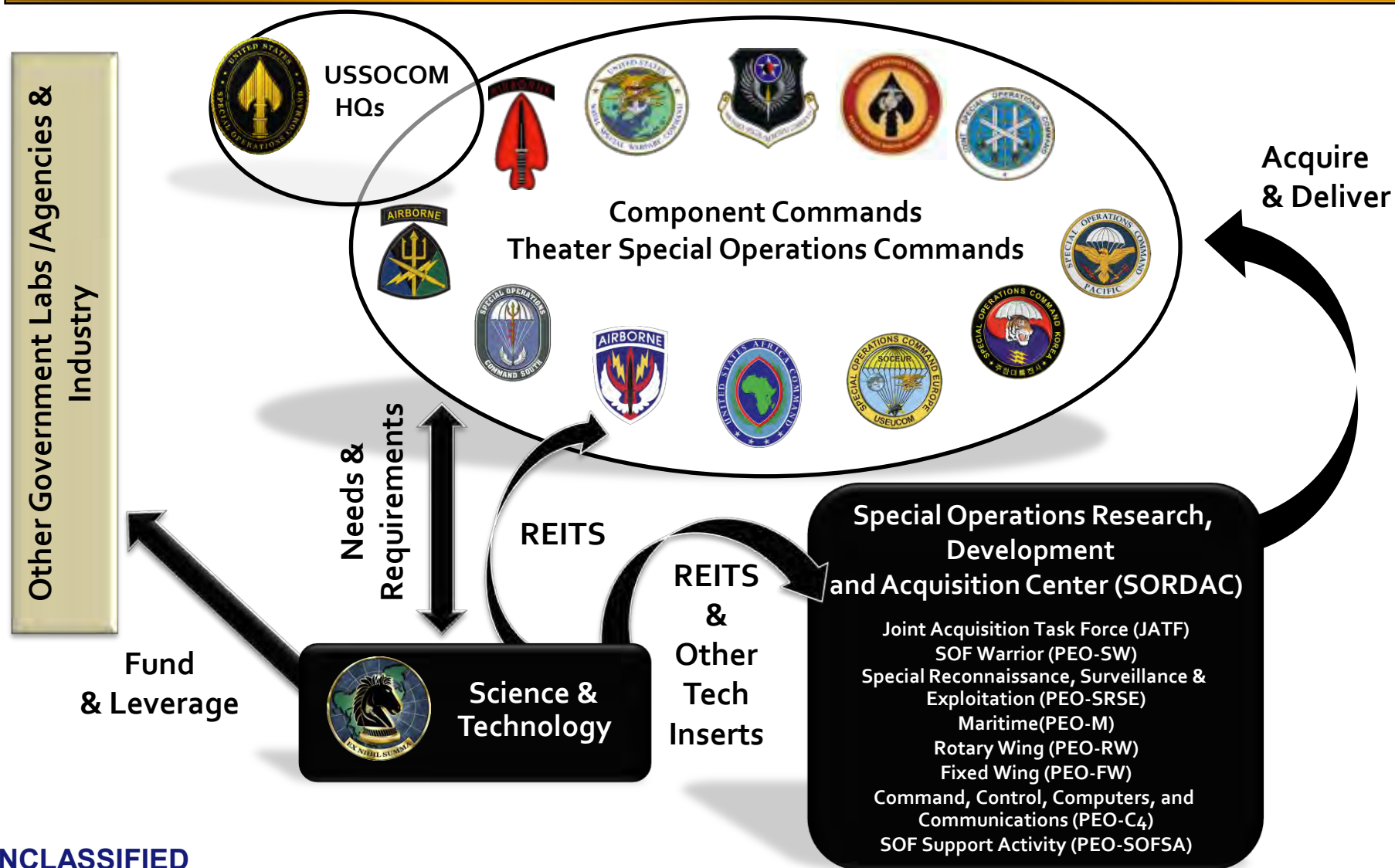
■ Two Cross-Commodities Focus Areas

- Experimentation & JCTDs
- SBIR Management





S&T Capabilities to the SOF Operator





SOCOM Unique Authorities

National Defense

Authorization Act of 1986

A Unified Combatant Command...

- Command of All U.S. Based SOF
- Plan and Synchronize DoD Activities in the Global War on Terrorism
- Deploy SOF to Support Geographic Combatant Commanders
- As Directed, Conduct Operations Globally
- Plan and Execute Pre-Crisis Activities



...With Service & Military Dept-like Responsibilities

- Organize, Train, Equip SOF
- Develop Strategy/Doctrine/Tactics
- Program and Budget
- Procure SOF-peculiar Equipment
- Monitor SOF Personnel
- Ensure Interoperability



Working with USSOCOM Technology and Industry Liaison Office (TILO)

- The TILO provides USSOCOM and Industry a means to rapidly identify, track, and assist with the efficient transition of emerging and needed technologies and capabilities to the SOF warfighter
- Mr. Chris Harrington (USSOCOM Director, Office of Small Business Programs and TILO)
- tilo@socom.mil
- TILO Hotline (813) 826-3200

A silhouette of a soldier in profile, facing left, against a bright orange and yellow sunset sky. The soldier is wearing a helmet with a mounted device and has a microphone near his mouth. The word "Questions?" is written in white, italicized font over the soldier's silhouette.

Questions?



Army Science & Technology



12th Annual Science & Engineering Technology Conference / DoD Tech Exposition

Providing Technology Enabled Capabilities



Dr. Marilyn M. Freeman
Deputy Assistant Secretary of the Army
for Research and Technology

June 22, 2011



We have been at War for 10 Years...

What have we Learned?





It's all about the Soldier – Basic Human Needs



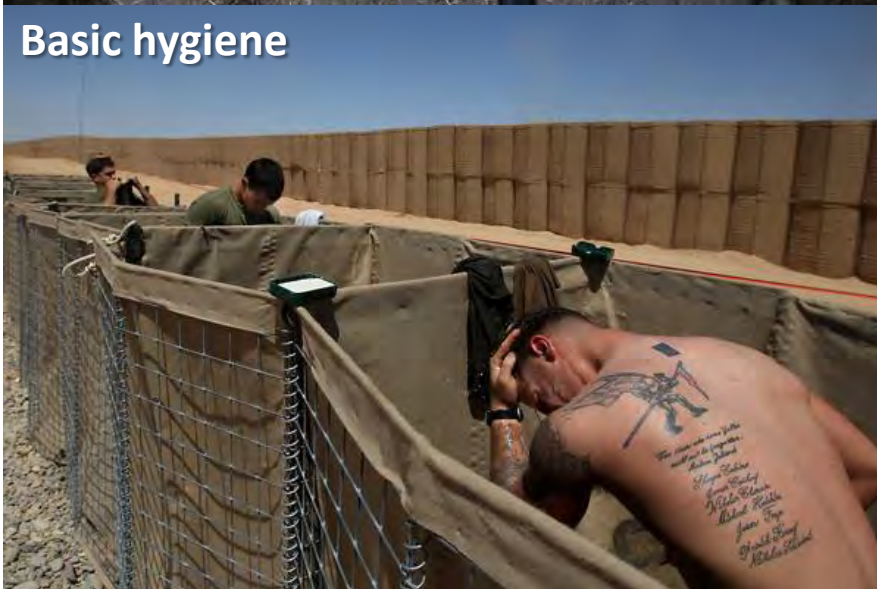
Sleep



Shelter & protection



Basic hygiene



Food & water





It's all about the Soldier – Expeditionary Maneuver / Tactical Force Projection



Unrestricted maneuver



Physical / Physiological



Access & Tactical resupply



Cognitive & Affective





It's all about the Soldier – Force Protection



In Action - Collective



On the move



In Action - Individual



At "rest"





It's all about the Soldier – Expeditionary Basing



Easy set up



Operationalized effectiveness



Performance focused



Adequate Reset & Recovery





It's all about the Soldier – Cognitive, Physical & Social Performance





It's all about the Soldier – Spiritual, Cultural, Social Needs





It's all about the Soldier – Cultural, Spiritual & Social Connectedness





It's all about the Soldier





This is What We Learned – It's all about the Soldier and ...



“In the past the small unit was built around the fighting system. Today and for the future, the fighting system must be built around the small combat unit.”

— MG(R) Robert Scales*

*Ground Combat Vehicle CONOPS -
Concept paper dated Dec 2, 2010





Army S&T Raison d'Être

Foster invention, innovation, maturation, and demonstration of technologies to enable Future Force capabilities while exploiting opportunities to transition technology enabled capabilities to the Current Force

Current Force



Modular Protective Systems



**IED/Mine
Detection Ground
Penetrating Radar**



**MRAP Expedient
Armor Program**



**Unattended
Transient Acoustic
MASINT System**

Enabling the Future Force



Enhancing the Current Force

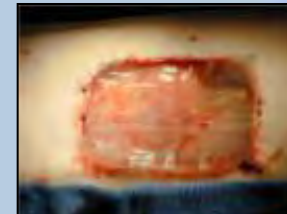
Future Force



Immersive Training



**Virus-based Self-
Assembling Electrodes**



**Regenerative
Medicine**

**Autonomous
Materiel
Handling
System**





DASA (R&T) Responsibilities

- Advise Army Leadership and the Acquisition Community on scientific and technical matters
- Maintain balanced S&T portfolio responsive to Warfighter needs—advocate and defend Army S&T investments
- Provide policy and guidance to the S&T Enterprise
- Promote technological innovation throughout the acquisition process
- Laboratory Management—improve/maintain health of Army labs/centers
- Assess technology readiness and facilitate transition to systems



**Principal Proponent and Accountable Senior Official for
Army Science, Technology and Engineering**





The Army S&T Workforce

Total Civilian Manpower: 18,640



- 10,949 Scientists & Engineers
- 1,443 S&E's are supervisors
- Approximately 9% new hires in FY10

Level of Education

- 37% of new hires from Tier 1 schools
- 35% of S&E have MS
- 14% of S&E are PhD



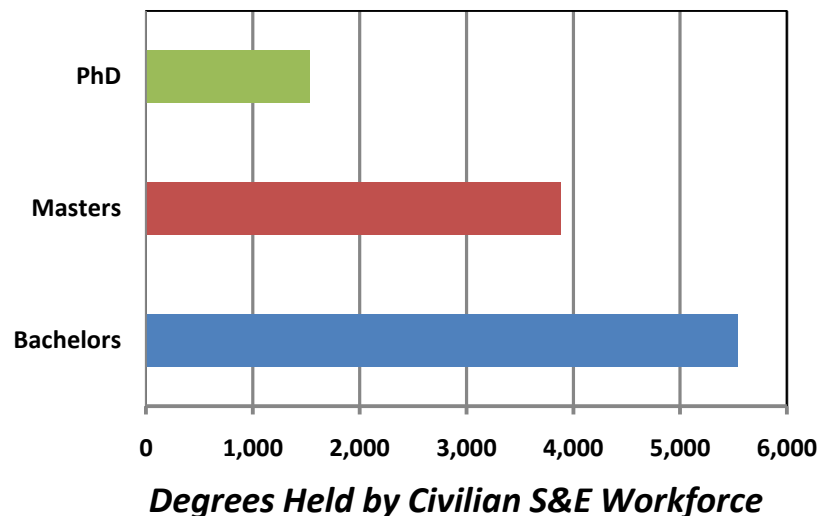
Expertise Across Lifecycle

- **Deployable Employees:**
 - field-deployable scientists, engineers, technicians and operators
- **Matrixed support to JPEO/PEO offices**
- **Military personnel**



Critical and Unique Research Competencies and Facilities:

- Sensors, Electronics, and Materials
- Human Performance and Behavioral Science
- Clothing and combat feeding
- Medicine and clinical research
- Infectious diseases and battlefield medicine
- Munitions and warheads
- Threat agent chemistry and biochemistry
- Biology and environmental sciences
- Geospatial
- Sensor technology for space applications
- Network, cybersecurity, and information fusion





DASA(R&T)'s Problem & Challenge



- **The Problem**
 - It takes too long to get technology enabled capabilities to the field
 - Army S&T is perceived as irrelevant
- **Fixing the Problem requires:**
 - New comprehensive strategy
 - Changing the culture
 - Restoring confidence in Army S&T
 - Building a strong Partnership with Leadership
 - Motivating the workforce towards results

**We have been working on this for a year –
and we are on the path to fixing it!**





Strategy for Change

Value Proposition for Army S&T



Vision

Provide technology enabling capabilities that Empower, Unburden and Protect our Soldiers and Warfighters in an environment of Persistent Conflict

Strategic Perspective for Success

Timely delivery of capabilities fostered by effective partnerships in synchronization with Army Force Generation and fiscal processes in accordance with the priorities of the Chief of Staff and Secretary

Respond Rapidly to Technological Evolution

New Metrics for Value of Army S&T:

- **The technical capabilities we provide to Warfighters**
- **The data and information we provide to decision makers**
- **The quality of the research, development, and engineering conducted in our laboratories and centers**
- **The contributions of our subject matter experts who participate in decision making activities**
- **The number of times we are called upon to provide innovative solutions to big Army/ DoD problems**
- **Our ability to effect positive change**





New Strategic Goals for Army S&T



**“World Class” Science
& Technology**

**Timely Transition of
the Right
Technologies**

**Recognized Leader in
Defense
Development and
Engineering**

**Strong Internal &
External Partnerships**

**High Quality,
Relevant Facilities
and Capabilities**

**A Balanced
Investment Portfolio**

**Highly Skilled,
Motivated Workforce
that Exemplifies our
Core Values**

**Effective, Efficient, &
Adaptable Processes**

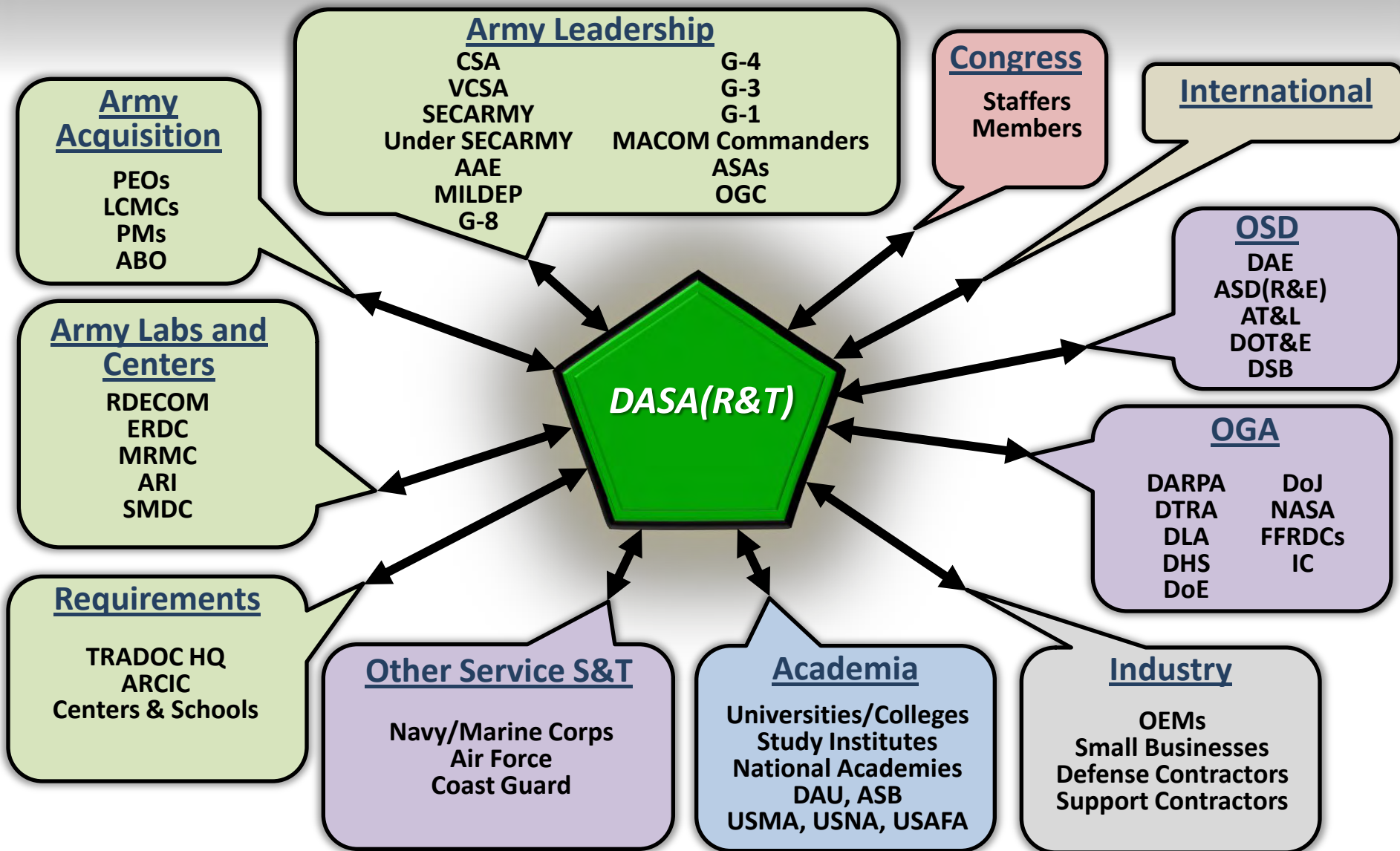
**Government and
Public Understanding
of Our Value**

**Overarching Goal: To be the Army Senior Leadership’s “Go-To” place for all
Science & Technology and Engineering issues**





Building Partnerships Across the Enterprise





DASA(R&T) – The New Organization

**Army Chief
Scientist**

OFFICE OF THE DEPUTY ASSISTANT SECRETARY OF THE ARMY (RESEARCH AND TECHNOLOGY)

**Exec Director, Strategic
Plans & Program
Planning**

**Exec Director, Programs
& Technology
Transition**

**Director for Warfighter
Technology
Implementation**

Portfolios

Director for Soldier Systems S&T

Director for Ground Systems S&T

Director for Air Systems S&T

Director for C³ Systems S&T

Director for Basic Research

Functions

Director for Lab Management & Educational Outreach

Director for Business & Operations

Director for Studies, Analyses & Assessment





Army S&T Alignment—Soldier Systems

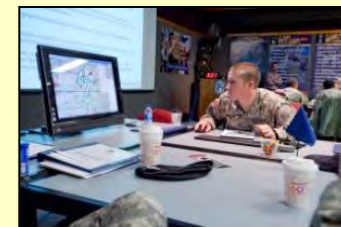
6.2 and 6.3 FY12



1. Data to Decisions
2. Engineered Resilient Solutions
3. Cyber Science & Technology
4. Electronic Warfare/Electronic Protection
5. Counter Weapons of Mass Destruction
6. Autonomy
7. Human Systems

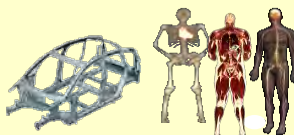
Human Dimension:

- Soldier Leader Training
- Equipment designs which reduce physical and cognitive burden during training, operations and reset
- Cultural Awareness



Soldier Load & Protection:

- Offloading technologies
- Lightweight, threat tailored, ballistic and blast components for Soldier mobility & survivability
- High density and efficient energy sources
- Decision aides for mission equipment planning
- Lethality assets that are lighter & environmental friendly
- Low-cognitive user interface technologies



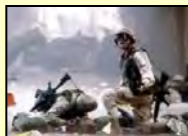
Mission Command:

- Dismounted Mission Command Technologies
- NSA approved wireless protocol & novel Soldier personal area network architectures
- Technologies with allow freedom of maneuver across battlespace
- Distributed information & situational awareness



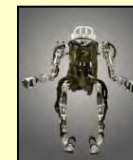
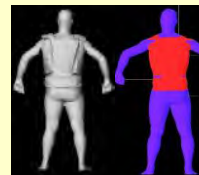
Health Promotion:

- PTSD and TBI treatments
- Suicide Prevention Study
- Psychological Resetting After Combat Deployment
- Nutrition Sustainment
- Fatigue Interventions



Combat Casualty Care:

- Regeneration of Damaged Tissue
- Ocular and Maxillofacial Trauma
- Musculoskeletal Injury
- Regenerative Medicine to Reduce and Repair Burn Injury
- Blood Products Research
- Wound Infection Countermeasures





Army S&T Alignment—Ground Systems

6.2 and 6.3 FY12



1. Data to Decisions
2. Engineered Resilient Solutions
3. Cyber Science & Technology
4. Electronic Warfare/Electronic Protection
5. Counter Weapons of Mass Destruction
6. Autonomy
7. Human Systems

Ground Vehicle Power and Mobility:

- High temperature power electronics
- Fuel cell for silent watch
- Prime Propulsion



Survivability:

- Occupant Centric protection systems
- Light-weight, multi-hit and multi-functional integrated armors
- More effective and compact KE defeat APS



Intelligent Ground Systems:

- Fully autonomous leader/followers
- Tactical formation
- Human Machine Interface



Unmanned Ground:

- Virtual testing of UMS
- Autonomous mobility performance in complex environments
- Soldier/robot and robot/robot teaming
- Autonomous Robotics Systems
- Indirect Vision Technologies
- Unmanned Systems Technology Development
- 360° Situational Awareness Technologies
- Soldier Machine Interfaces



Deployable Force Protection:

- Integrated, lightweight protection technologies for small bases (<300 people)
- Line-of-sight and non-line-of-sight detection
- Organic active and passive defense
- Robust and resilient systems





Army S&T Alignment—Air Systems

6.2 and 6.3 FY12



1. Data to Decisions
2. Engineered Resilient Solutions
3. Cyber Science & Technology
4. Electronic Warfare/Electronic Protection
5. Counter Weapons of Mass Destruction
6. Autonomy
7. Human Systems

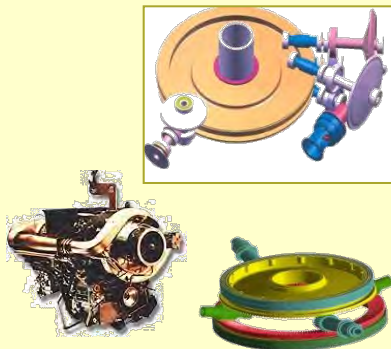
Platform Technologies:

- Joint Multi-Role Technology Demonstrators
- Rotorcraft Airframe Technology
- Platform Durability & Damage Tolerance
- Air Vehicle Structures & Dynamics Technology
- Aviation Weapons Integration



Operations and Support:

- Propulsion and Drive Trains
- Increased Fuel Efficiency
- Lighter Weight Components
- Small Heavy Fuel Engine
- Improved Reliability and Durability
- Reduced Weight/Vibration



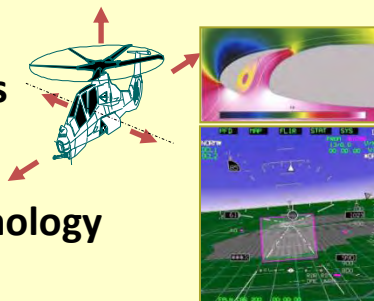
Survivability:

- Integrated ASE Architecture
- EO/IR Countermeasures
- Hostile Fire Warning & Visual Cueing
- Affordable Directional IR Jamming
- Increase Survivable Crash Envelope



Rotors & Flight Controls:

- Active Rotors and Controls
- Future Rotary Wing Concepts
- Advanced Rotor System Development
- Reconfigurable Vehicle Technology
- Reconfigurable Rotors



Unmanned Air:

- Autonomous Behaviors
- Unmanned Cargo Resupply
- Manned-Unmanned Teaming
- Video from Unmanned Aerial Systems for Interoperability Teaming (VUIT)
- Bi-Directional Remote Video Terminal (BDRVT)





Army S&T Alignment—Command, Control, and Communications Systems

6.2 and 6.3 FY12



1. Data to Decisions
2. Engineered Resilient Solutions
3. Cyber Science & Technology
4. Electronic Warfare/Electronic Protection
5. Counter Weapons of Mass Destruction
6. Autonomy
7. Human Systems

Intelligence & Electronic Warfare:

- **Fusion** for timely, accurate SA
- **Networked** EW assets for simultaneous and autonomous detection, classification, and geo-location of modern emitters/threats in all terrains
- Surgical disruption and/or neutralization of C4ISR nodes and RCIEDs



Communications:

- **GIG** voice/data connectivity for dismounted Soldiers
- **Tactical** access to military Smartphone applications
- **Intrusion** Detection Systems to detect/protect and reduce network downtime from cyber threats
- **Cross** Domain Solution for bi-directional info sharing
- Affordable phased-array antennas for OTM Satcom



Mission Command:

- **Mission-aware** data mining and reasoning software agents for decision making and communications utilization
- Custom C2 applications from existing software components and services
- **Mission** Command software services – able to plan, deploy and manage unmanned missions
- **Software** for Collaboration Services and Decision Support Software Products



Sensors:

- New growth methods and structures enabling lower cost, large format IR FPAs:
 - Superlattice & Barrier (“nBn”) detectors
 - Novel digital readout integrated circuit (ROIC) technology
- Radar technologies for 360 Degree Hemispherical Coverage
- **Standoff** capability to characterize urban structures





Army S&T Alignment—Basic Research

6.1 FY12



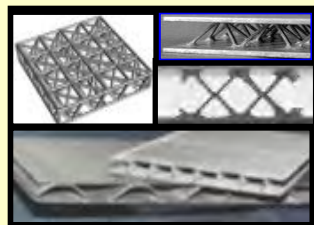
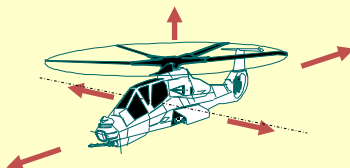
UARCs:

- Soldier Nanotechnology
- Collaborative Biotechnology
- Creative Technology
- Electromagnetics & Hypervelocity Physics



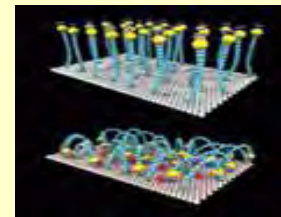
Centers for Enduring Needs:

- Vertical Lift Research
- Materials Research
- Automotive Research
- High Performance Computing
- HBCU/MI



University Initiatives:

- Single Investigators
- MURI
- DURIP
- PECASE



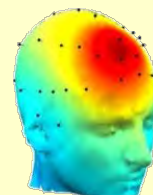
Collaborative Technology Alliances:

- Micro Autonomous Systems Technology
- Robotics
- Cognition & Neuroergonomics
- Network Science



Inhouse Research:

- Core Programs
- ILIR





Army Basic Research Focus Areas

1. **Nano Science and Engineering**
2. **Cognitive Neuroscience**
3. **Quantum Systems**
4. **Engineered Materials**
5. **Modeling of Human Behavior**
6. **Synthetic Biology**

Network Science

Research in human-engineered and biologically-evolved networks to improve performance, increase reliability & enhance network-centric mission effectiveness



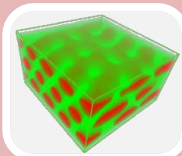
Immersive Technology

Revolutionize military training and mission rehearsal through the development of technology and art for simulation experiences and the development of virtual human technology



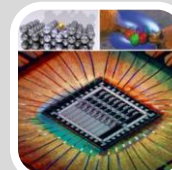
Materials Modeling

Research to develop fundamental science principles at & across scales and develop underpinning, cross-cutting, and transferrable physics-based modeling capabilities



Quantum Effects

Generate advances in quantum sciences that will enable revolutionary approaches to information processing, cryptography, information assurance, and communication



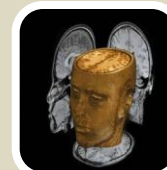
Nanotechnology

Discover and create new materials with properties that will revolutionize military technology and make Soldiers less vulnerable to the enemy and environmental threats



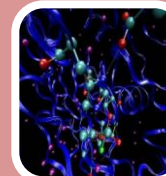
Neuroscience

Research in learning, decision models and the functional brain to improve training techniques, human-machine interface design, and to more fully understand the decision-making process



Biotechnology

Research to understand biological construction of novel materials, structures and processes to develop biologically-inspired materials, sensing systems, information processing and power & energy



Autonomous Systems

Discover, develop and exploit robotic devices and systems with highly sophisticated sense, response and processing systems approaching that of biological systems to dramatically enhance Soldier survivability





Army Educational Outreach Program

Strategy: Follow the Path to Become Scientists and Engineers

Science Introduction – Grades K-5

NSC

Competitions and Experiences!

Competition – Grades 6-9

eCybermission, Junior Solar Sprint

Up to \$7,500 in savings bonds

Lab Experiences – Grades 6-9

GEMS, Near Peer Mentor

Up to \$250 stipend a week!

Competition – Grades 9-12

JSHS, IMO, ISEF

Up to \$50,000 in cash & prizes!

Mentor Programs – Grades 9-12

UNITE, REAP, SEAP, HSAP/UAP

Up to \$5,000 a summer!

College Programs

SEAP-CQL, WISP, CREST, CRFP, SMART

Full scholarship and up to \$45,000 a year!

<http://www.usaeop.com>



DESIGN • DEVELOP • DELIVER • DOMINATE
SOLDIERS AS THE DECISIVE EDGE



062211_Freeman_NDIA_SET_Final



Executing the Strategy

The Current Basis (going in)

OSD FY 2013-17 Priority Areas

- Data to Decisions
- Engineered Resilient Systems
- Cyber S&T
- Electronic Warfare/Protection
- Counter WMD
- Autonomy
- Human Systems

Army S&T Priority Challenges !!!

Army FY 2013-17 Warfighter Outcomes

- Training
- Mission Command
- Power and Energy
- Counter IED and Mine
- Human Dimension
- (156 supporting outcomes)

PLUS Unified Quest Data

Operational Experiences from 10 Years of War

WORKSHOP

Army FY 2014-18 Army S&T Challenges to Close High Priority Gaps*

- What: Goals, Objectives & Metrics
- When 2-3 year deliverables
- Why: Addresses high priority Army needs or new capability
- Application: Targeted Mission Areas
- Defined Capability Gap: Provides enhanced or new capability

Guidance to
S&T Community

Program Building

5-10 Yr Programs
6.1/6.2

planning, vetting, identification of enabling technologies, utility analysis, identification of milestones, timing, and resourcing

Army
FY 2014-18
Technology
Enabled
Capability*
Demonstration
Programs

2-3 Yr Programs
6.2/6.3

*For the first time, the Army will have Senior Leadership buy-in to Army S&T priorities

Workshop focus

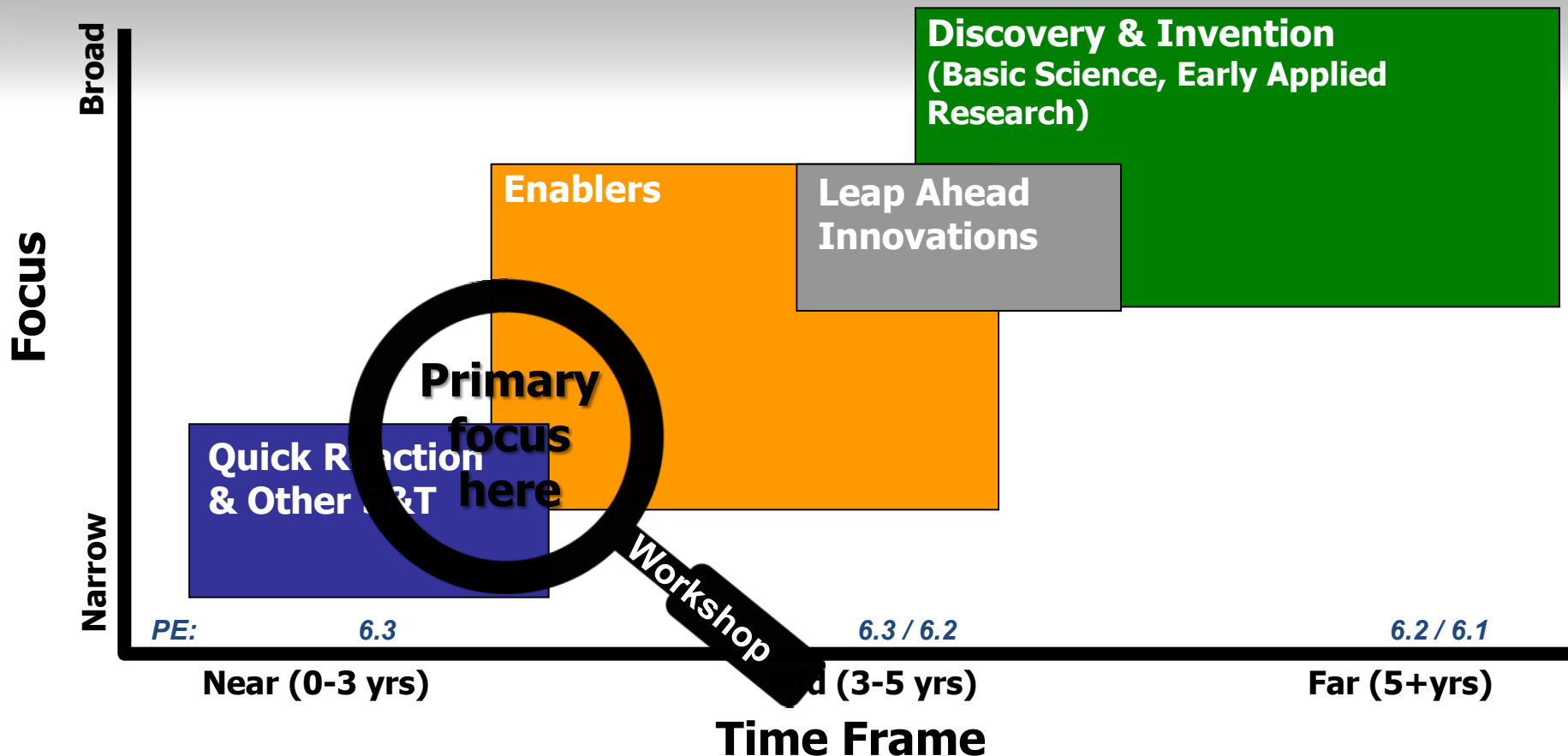
ASTAG/ASTWG Process





Big Challenge Action Plan

Balanced S&T Portfolio



Quick Reaction

- Tech Solutions
- Rapid insertions
- Experimentation
- JUON solutions

Enablers

- Applications research for specific military problems
- Tech insertion, integration & transition
- Components, subsystems, models,

Leap-Ahead Innovations

- Skunkworks, integrated evaluations, concepts & wargaming
- Innovative alternative generation, assessment, demonstration and evaluation

Discovery & Invention

- Basic & Early Applied Research
- Education Outreach
- Knowledge for uncertain future





Technology-Enabled Capability Demonstrations (TECDs)



- **Definition:** A technology or set of technologies that either measurably enhance performance and effectiveness of an existing capability or enable a new and necessary capability for the Warfighter - focus on solving near term challenges that are priorities for the Army
- **TECD Considerations**
 - TECDs require collaborative program planning (typically cross-organization)
 - TECDs focus on transitioning a capability to meet an agreed upon goal at an agreed upon time
 - Failure of a component technology within a TECD does not necessarily equate to TECD failure
 - Risk management/mitigation strategies take on a new significance within the S&T community – achieving overall capability goal is key





In Summary...

- **We are changing the Army S&T business model to be an enduring, sustainable, successful enterprise model**
- **We are aligning our strategic planning to the budget processes so that we are more efficient and able to achieve “top-down” S&T leadership investment focus**
- **We are identifying critical Army problems that we can solve in the near and mid-term, using the best talent and skills wherever they exist**
- **We are enhancing visibility of Army S&T priorities to provide partnering opportunities to jointly solve problems and enhance our Warfighter capabilities**

**The better we understand our needs and priorities –
the better able our enterprise will be to give us capability solutions**





My Challenge to You

- **Assist us in providing our Soldiers a decisive edge**
- **Engage in the discussions at this conference**
- **Strengthen your partnership with the Army**

You can help define the architecture, concepts, components and technology to enable the Soldier and small combat unit to achieve the capabilities needed in an environment of persistent conflict and full spectrum operations.



Army Science & Technology



Providing Soldiers Technology Enabled Capabilities





Science and Engineering

Technology Conference/DoD Technology Expo

Jim Smerchansky

**Deputy Commander, Systems Engineering, Interoperability,
Architectures and Technology (SIAT)**



22 June 2011

MARINE CORPS SYSTEMS COMMAND

EQUIPPING THE WARFIGHTER TO WIN

Our Priorities



Continue to provide the best trained and equipped Marine units in Afghanistan



Rebalance our Corps and posture it for the future

MARINE CORPS SYSTEMS COMMAND

EQUIPPING THE WARFIGHTER TO WIN

Our Priorities



***Better educate and train
our Marines to succeed in
complex environments***

***Keep the faith with our Marines,
our Sailors, and our families***





- Energy
- Vehicles/Protected Mobility
- Lighten the MAGTF



MARINE CORPS SYSTEMS COMMAND

Energy



EQUIPPING THE WARFIGHTER TO WIN



MARINE CORPS SYSTEMS COMMAND

Energy



EQUIPPING THE WARFIGHTER TO WIN





EQUIPPING THE WARFIGHTER TO WIN

At the Tactical Edge Water is the Problem



Data Source CLB-8 period June 13 – September 11 2009

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MARINE CORPS SYSTEMS COMMAND

EQUIPPING THE WARFIGHTER TO WIN

Vehicle Survivability



MARINE CORPS SYSTEMS COMMAND

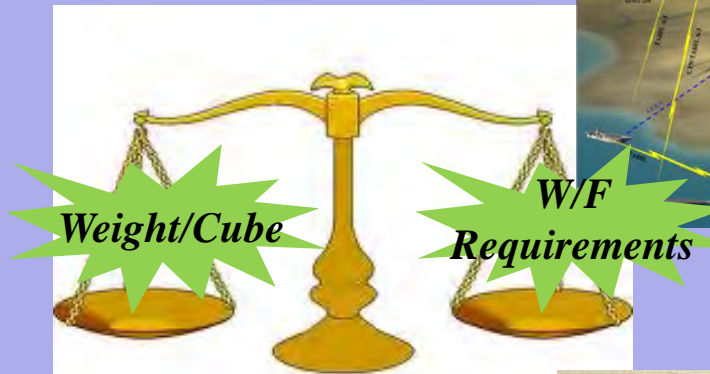
EQUIPPING THE WARFIGHTER TO WIN

Vehicle Mobility



“We will rebalance our Corps, posture it for the future and aggressively experiment with and implement new capabilities and organizations.”

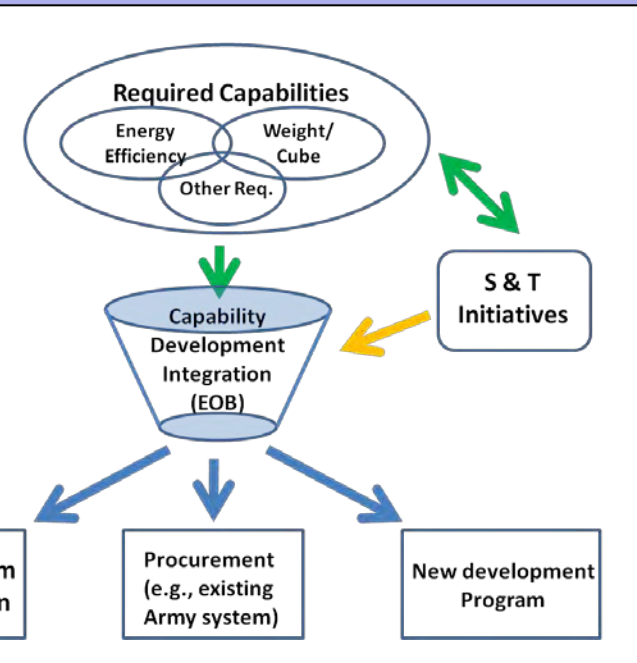
The Challenge



**Affordability /
Technology**



**Create the Middleweight MAGTF
within Affordability Constraints**



Capability Solutions



EQUIPPING THE WARFIGHTER TO WIN

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Issue: Increasing Power Consumers

Individual Marine Power Requirements



AN / PVS-17
AA Battery



AN / PVS-14
AA Battery



AN / PAS-13D
AA Battery



AN / PEQ-16A
DI-123A Battery



Hand-held flashlight
AA Battery



MIOX Water Purifier
AA Battery



AN / PSC-13 D-DACT
Unique or AA Battery



DAGR
AA Battery



AN / PRC-148 or 152
Unique Batteries



AN / PRC-153
Unique Battery



Quiet Pro Headset
Unique Battery



Squad Digital Camera
Unique Battery



AN / PRC-117F
BA-5590 / BA-5390 / BB-2590 Batteries



Rugged Laptop
Unique Battery

MARINE CORPS SYSTEMS COMMAND

Dismounted Weight

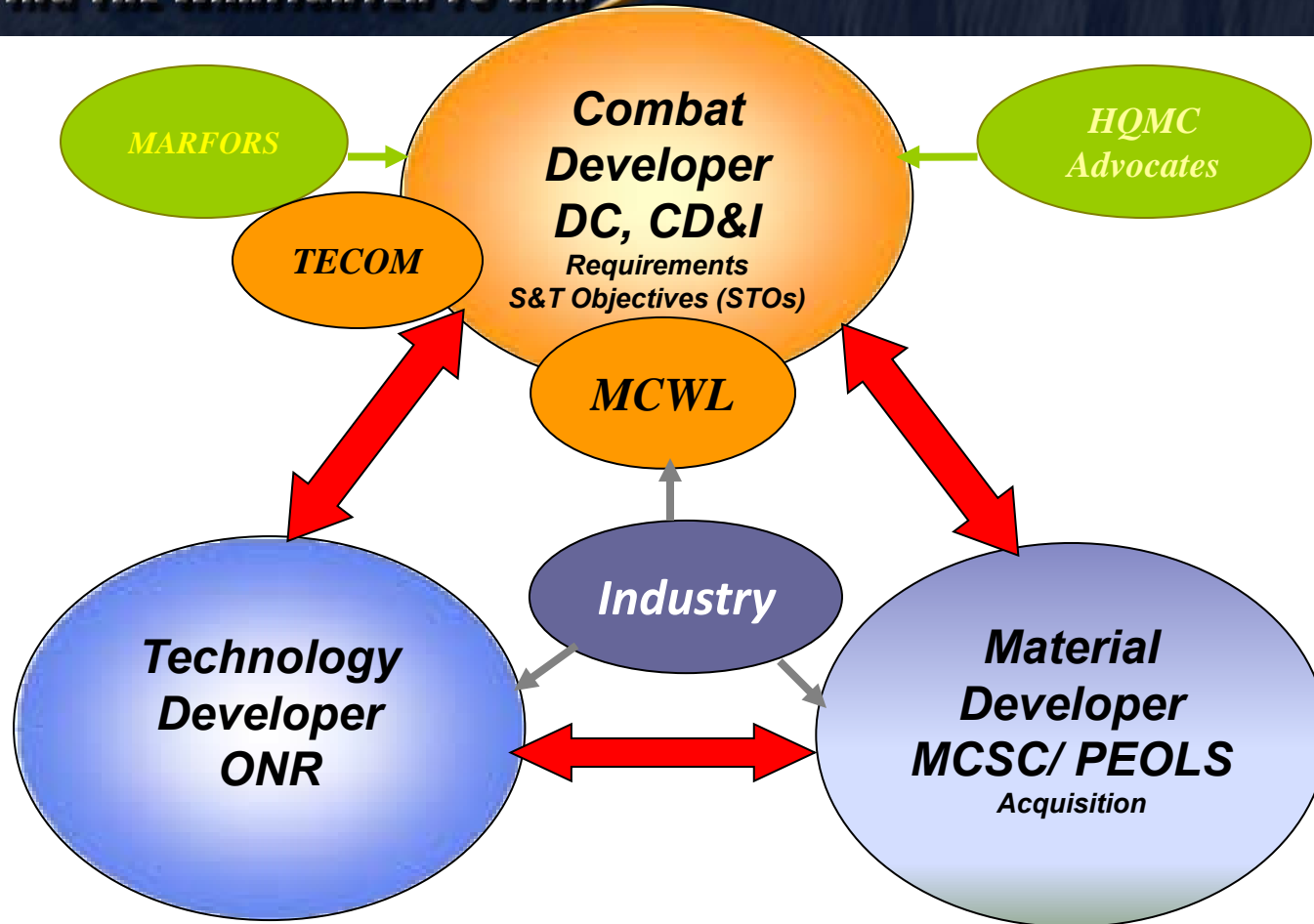
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MARINE CORPS SYSTEMS COMMAND

EQUIPPING THE WARFIGHTER TO WIN

*Doing Business with
the Marine Corps*



<http://www.marcorsyscom.usmc.mil>

- POCs

- S&T Strategic Plan

- Technology Needs

MARINE CORPS SYSTEMS COMMAND

EQUIPPING THE WARFIGHTER TO WIN

*Doing Business with
MCSC*



Marine Corps Systems Command - Microsoft Internet Explorer provided by NMCI

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MARINE CORPS SYSTEMS COMMAND

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What's New at Marine Corps Systems Command:

- [Command Magazine: Marines On Point \(Summer 2009\) – 10/6/2009](#)

First M-ATVs deploy to Afghanistan

With unprecedented speed, the first of thousands of Mine Resistant Ambush Protected (MRAP) All Terrain Vehicles (M-ATV) are being deployed to Afghanistan with a highly survivable and off-road-capable vehicle just three months after a delivery order was awarded to protect warfighters.

MRAP vehicles feature a V-shaped hull to deflect roadside bombs and are proven to be lifesavers on the battlefield. The procurement of the M-ATV grew from an urgent requirement to provide troops a smaller and more maneuverable vehicle that can travel off-road and navigate Afghanistan's difficult, mountainous terrain.



Doing Business with MARCORSYSCOM

- Vendor Information
- Acquisition Center for Support Services
- Contracts
- Counsel
- Office of Small Business Programs

Admin & Press

Done Internet



- MCSC DIR TT&S: David Ungar david.m.ungar@usmc.mil 703-432-3950
- PEO LS DIR S&T: Mike Halloran Michael.d.halloran@usmc.mil 703-432-5406
- MCSC TT&S, STO: Lou Carl louis.carl@usmc.mil 703-432-3770
- SBIR Manager: Paul Lambert paul.a.lambert@usmc.mil 703-432-3033
- MAGTF Command & Control (PG11):Chris Zaffram
christopher.zaffram@usmc.mil 703-432-4178
- Communications and INTEL Systems (PG12):Martin Jackson
martin.jackson@usmc.mil 703-432-5150
- Infantry Weapons Systems (PG13):Mike Tang mike.tang@usmc.mil 703-432-4259
- Armored Vehicles & Fire Support Systems (PG14): Bryan Freeman
bryan.freeman@usmc.mil 703-432-4259
- Ground Transportation, Engineer Systems & Electrical Power (PG15): Scott Story
William.story@usmc.mil 703-432-3695
- Combat Equipment & Support Systems (PG16): John O'Donnell
john.h.odonnell@usmc.mil 301-908-1194
- MCTSSA: Mike O'Neil mike.oneil@usmc.mil 760-725-2502
- Counter IED: Maj Brian Stamps brian.stamps@usmc.mil 703-432-3921

These POCs match technology to Program Needs



“There is little that will sober an enemy more surely than the knowledge that somewhere, just over the horizon, lies a force of well-trained, well-equipped Marines in competently manned ships capable of delivering a stunning amphibious blow at a point and time of their own choosing.”

Lieutenant General, Victor Krulak, United States Marine Corps

U.S. European Command Technology Requirements

Stephen L. Spehn, Deputy Science Advisor

23 June 2011



United States
European Command
"Stronger Together"

Mission

- Defend the Homeland forward and support U.S. strategic interests
 - Maintain ready forces for global operations
 - Secure strategic access and enable global freedom of action
 - Enhance trans-Atlantic security through support of NATO
 - Promote regional stability
 - Counter terrorism

Building Partner Capacity is essential
to all our efforts



Technology Solutions

- EUCOM needs innovative technology solutions to emerging and persistent security concerns
- These solutions may involve non-traditional partnerships executing on accelerated schedules
- These partnerships will need to include:
 - Government agencies with equities in the problem
 - Prime contractors with success in DoD acquisition
 - Small technology providers that are adaptive and agile
 - A coordinating entity to bring it all together



Technologies of Interest (1 of 8)

- Building Partner Capacity
 - Multi-modal collaboration tools using non-proprietary software that adheres to internationally recognized open standards and is free of ITAR restrictions
 - Cross-language tools that support mixed-mode collaboration
 - Portable, renewable power generation, storage, and distribution to self-configuring grids



Technologies of Interest (2 of 8)

- Information Sharing
 - Cross-domain VTC
 - Dynamic language translation for chat and HTML sites
 - Advanced modeling for decision-support of environmental areas of regional interest
- Socio-Cultural and Regional Awareness
 - Large data-volume collection and visualization capability across all classifications and specified taxonomies, with modeling & simulation to project alternative futures



Technologies of Interest (3 of 8)

- Non-Lethal Weapons (NLW)
 - Halt or disable personnel out to 300 meters
 - Halt or disable
 - Ground vehicles up to 500 meters
 - Surface maritime vessels up to 850 meters
 - Enhance high energy lasers and high powered microwaves to provide NLW capability
 - Smaller size
 - Lower weight
 - Less power



Technologies of Interest (4 of 8)

- Biometrics
 - High-volume, multi-national biometrics matching capability providing firewalled query access to participating nations' biometrics databases with broad category match indications
 - Advanced biometric identification capability to include: facial; voice; iris; and long-distance, high-speed DNA
 - Infrastructure for sharing biometric information



*United States
European Command*
"Stronger Together"

Technologies of Interest (5 of 8)

- Persistent ISR
 - Low cost
 - Small logistics tail
 - Minimal operational manpower
 - Expendable equipment
 - Day/night and all-weather
 - Automated processing
 - In-theater tasking



*United States
European Command*
"Stronger Together"

Technologies of Interest (6 of 8)

- Enhanced Logistics Capabilities
 - Point of Need Delivery
 - Reduced requirements for supporting infrastructure
 - Reduced dependence on foreign oil
 - Hybrid Airships
 - Green efficiency
 - Heavy Lift
 - Avoid logistics choke points
 - Outsized cargo
 - ISR capabilities



Technologies of Interest (7 of 8)

- Cyberspace Domain Awareness
 - Enhanced ability to monitor and influence network operation
 - Increased cyber intelligence, surveillance, and reconnaissance
 - Greater information assurance
 - Reduced reaction time



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European Command*
"Stronger Together"

Technologies of Interest (8 of 8)

- Technology Enablers
 - Low-cost, configurable, multi-purpose small satellites
 - Low-cost small satellite launch platforms
 - Long-life, high-density power storage and management at all levels: from individual soldier through theater
 - Precision location and navigation independent of GPS



*United States
European Command*
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Contact

- Name: Stephen L. Spehn
- Email: stephen.spehn@eucom.mil
- Phone: +1.256.961.7095



United States
European Command
"Stronger Together"

U.S. SOUTHERN COMMAND

Opportunities, Challenges, and Required Capabilities in the Americas

Ricky O. Stuart
Science & Technology Program Manager
23 June 2011



UNITED STATES SOUTHERN COMMAND
P A R T N E R S H I P F O R T H E A M E R I C A S



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Key Missions – S&T Focus

- Countering Illicit Trafficking
- Humanitarian Assistance and Disaster Relief
- Peace Support Operations

US
SOUTH
COM

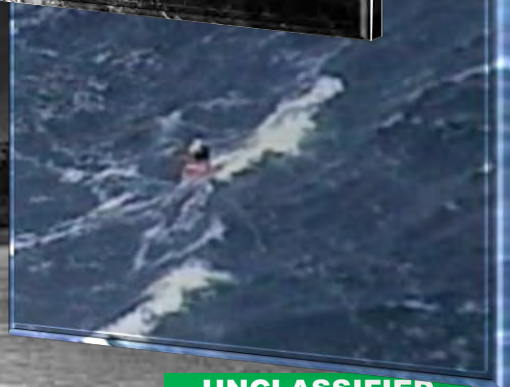
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Illicit Trafficking – The Challenge

- Dense Jungle Foliage
- Riverine Basin
- Broad Open Ocean
- Littoral Areas
- Urban Centers



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**US
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COM**



Countering Illicit Trafficking: Source Zone



- Jungle Environment
- Adaptive, Well-funded Adversaries
- Limited Infrastructure

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Countering Illicit Trafficking: Transit Zone

- Vast Ocean
- Limited Capacity
- Emerging Targets of Interest



US
SOUTH
COM



Countering Illicit Trafficking: Transit Zone

- Vast Ocean
- Limited Capacity
- Emerging Targets of Interest



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Humanitarian Assistance / Disaster Relief: Supporting Regional First Responders



- Renewable Water and Energy
- Communications
- Situational Awareness
- Logistics

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COM



Humanitarian Assistance / Disaster Relief: Supporting Regional First Responders



- Renewable Water and Energy
- Communications
- Situational Awareness
- Logistics

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Peace Support Operations



- Information Sharing
- Regional Cooperation
- Interoperability

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SOUTH
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Discussion



Next Generation Space Access

Bruce Thieman
Responsive Space Access
Capability Lead &
Hypersonics Area Planner



Overview



- **USAF Vision for Assured Space Access**

- Near Term: Responsive Reusable Booster Stage
- Far Term: Technology Challenge



AF Responsive Space Access

Expendable
Solids &
Liquids



Small
Launch
Vehicle
(SLV)

Reusable First
Stage

RBS Flagship

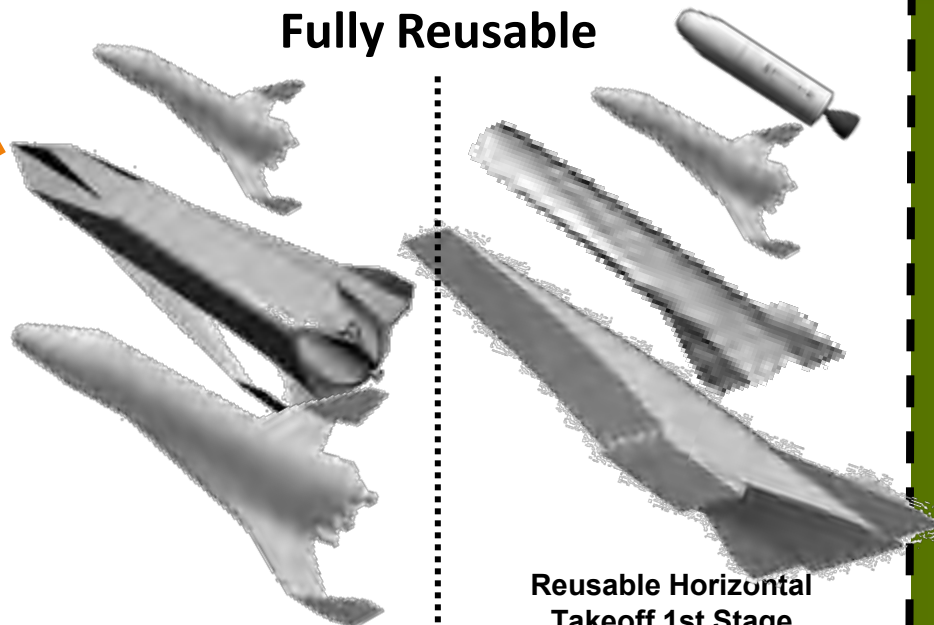


Hybrid

**Reusable 1st
Stage Vertical
Takeoff**

**15K lbs to Low
Earth Orbit**

Fully Reusable



Reusable 2nd Stage

**Fully Reusable
Payoff – +40%
payload incr.**

**Ex: Reusable
Rocket & Rocket-
Scramjet Based
Combined Cycle**

Reusable Horizontal
Takeoff 1st Stage

Payoff –

**Flexible Basing
10K lbs to Low
Earth Orbit**

**Ex: Turbine-
Scramjet Based
Combined
Cycle**



**Advanced
Concepts**

New Paradigms

2010

2017 - 2020

~2025

~2030

2035+





RBS: Responsive, Lower Cost Booster Stage – Ops Concept

~ Mach 3.5 - 7 Separation
lowers thermal protection
requirement

Deploy
payload

Boost
Back

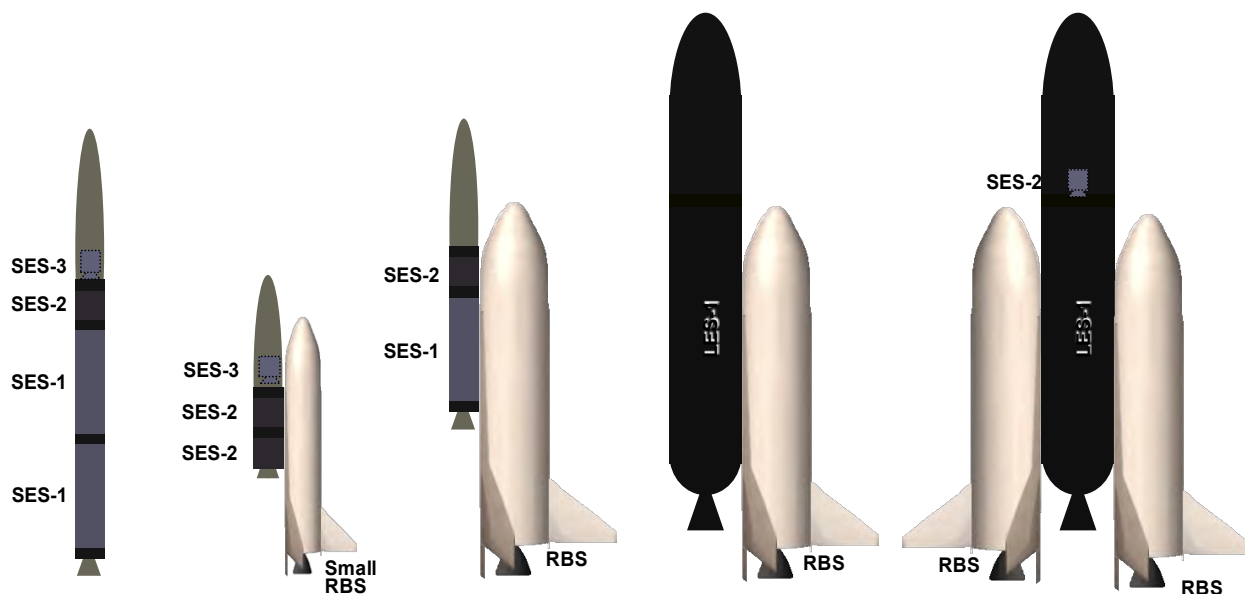
AFRL S&T Goals
Reusable Booster
+
Expendable Upper Stage
Potential

- 66% cost reduction
- 24-hr booster turn-around
 - 2-8 hr call up
- Flexible basing

Concept stretches S&T Gamut of Possible Solutions



Next Generation Launch System Near Term



	Small	Small	Med-Lite	Medium	Heavy
Lb to LEO	5,000	5,000	16,500	50,000	64,000
Cost savings	0	~33%	~50%	~50%	~50%
Approx IOC	2015-2020	2019	2025	2025	2030

What is RBS Flagship?

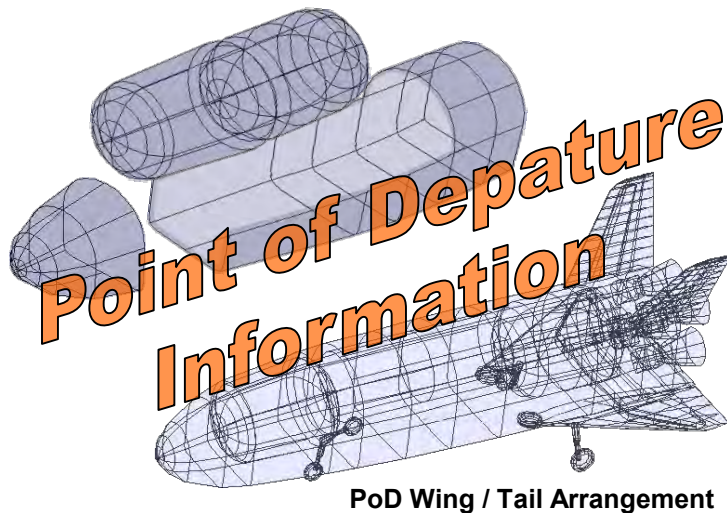
- Built Upon Small and Affordable Experiments -



Point of Departure (PoD) Design

Propulsion	4 Chase-10s
Length	~ 45 ft
GLOW	~ 60K lbm
Dry Weight	~ 16K lbm
Stage PMF Goal	~ 73%

PoD Fuselage Structural Concept

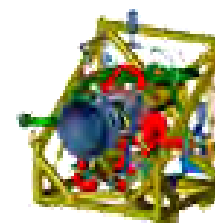


➤ Step 1 – Ground experiments



Airframe Experiment

Propulsion Options



Subsystems Experiment(s)

➤ Step 2 – Prove Rocketback

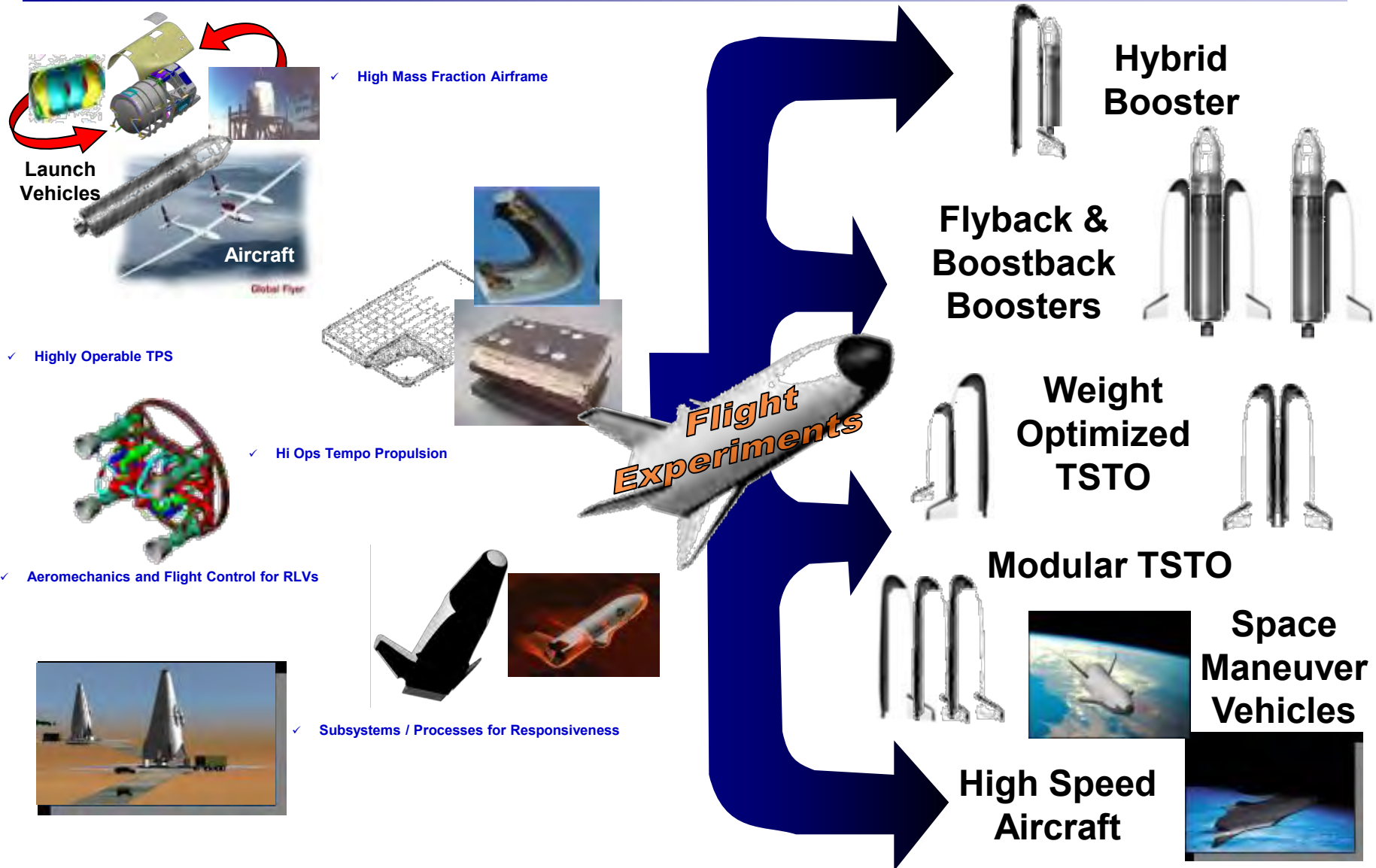


➤ Step 3 – Incremental flight test of X-vehicle



RBD Flight Experiment

- Technology for Multiple Future Flight Systems -





Broad Spectrum of Technologies for Responsive Space Access



Materials



Propellant
Tanks

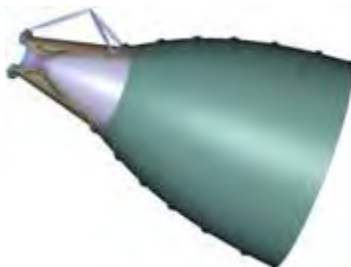


Leading
Edges



Thermal
Management

Propulsion



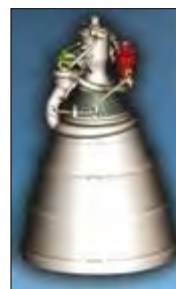
OMS, RCS



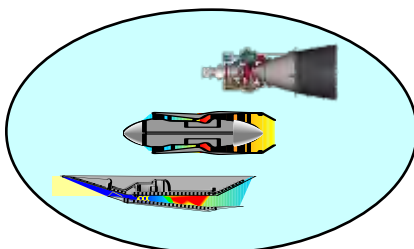
HC Boost
Engine



Solids

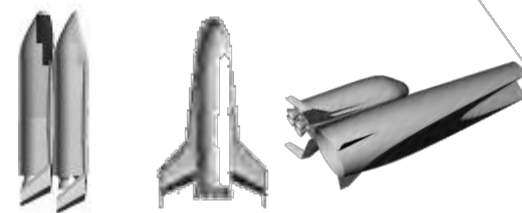


Upper
Stage
Engine

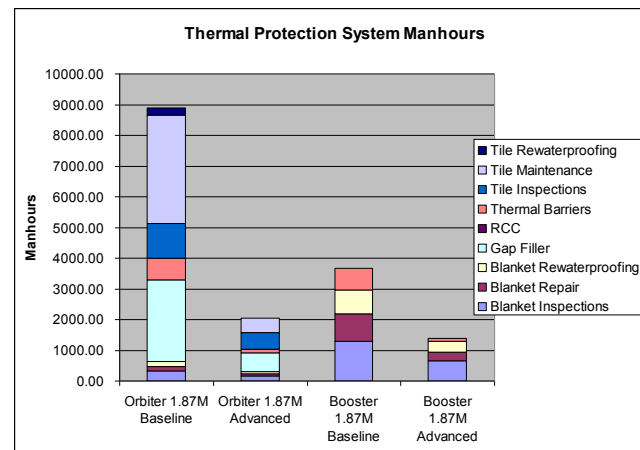


Combined Cycle
Engines

Vehicle Concepts



System Trades & Tech Assessment

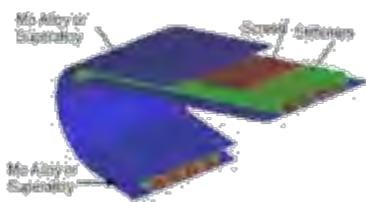




Broad Spectrum of Technologies for Responsive Space Access



Structures



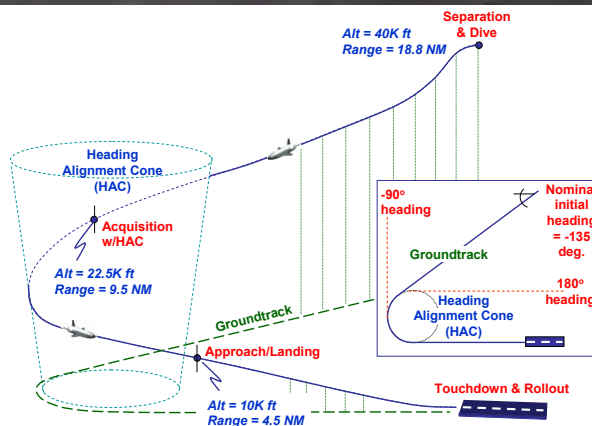
Leading Edges



TPS Hot Structures

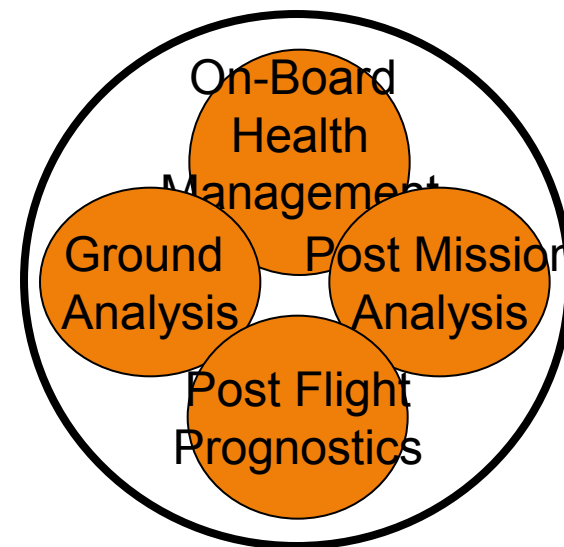


Guidance & Control



Cleared for Public Release AFRL/WS 07-0499

Vehicle Health Management



Architecture & Hardware





RBS Operations



Cleared for Dist A: 88ABW-2011-1421





RBS Demos



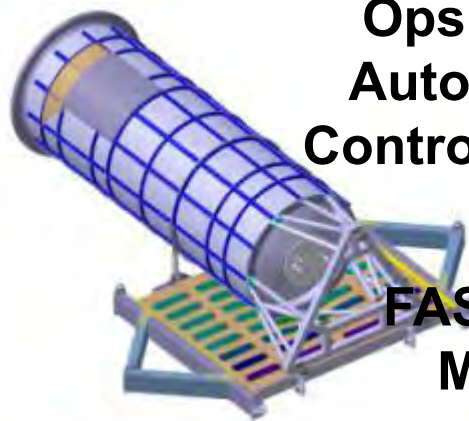
Pathfinder CONOPS and Rockeback flight demo 2014



Rocket Engine Rapid Remove and Replace 2010 & TPS R&R 2011



Ops Control Center, and Autonomous Guidance & Control Ground Experiments 2011



FAST Airframe and Health Management Ground Experiments 2013

Hydrocarbon Boost 250K lbs thrust Brassboard 2019





Overview



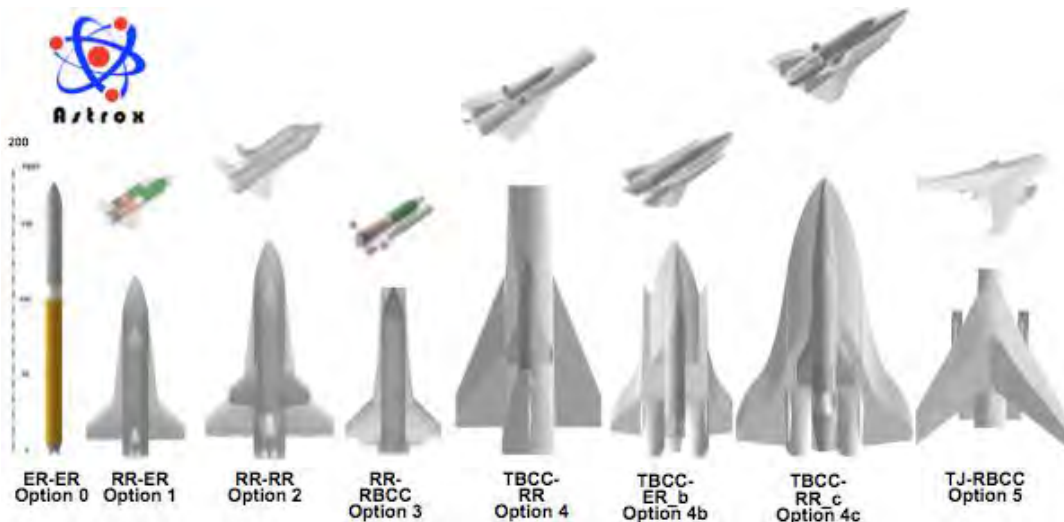
- **USAF Vision for Assured Space Access**
 - Near Term: Responsive Reusable Booster Stage
 - Far Term: Technology Challenge



Airbreathing Two-Stage-to-Orbit (TSTO) Access to Space Vehicles

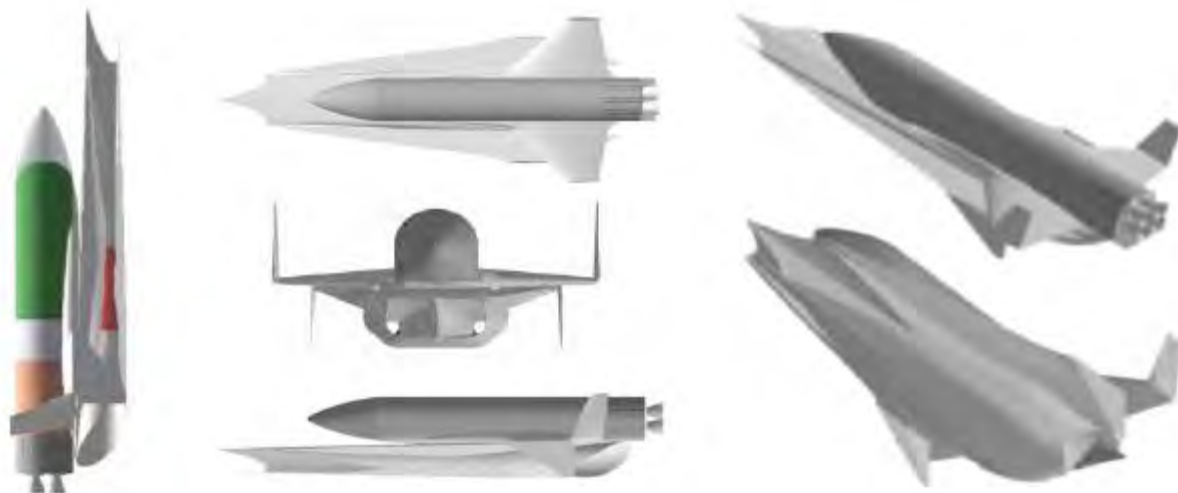


- ❑ Airbreathing systems offer enormous advantages for TSTO access-to-space; reusable space access with aircraft-like operations
- ❑ Air Force / NASA conducting joint configuration option assessments using Level 1 & 2 analyses
- ❑ Reusable rockets (RR), turbine-based (TBCC) and rocket-based (RBCC) combined cycles





Tech Horizons - 2.26. Reusable Airbreathing Access-to-Space Launch



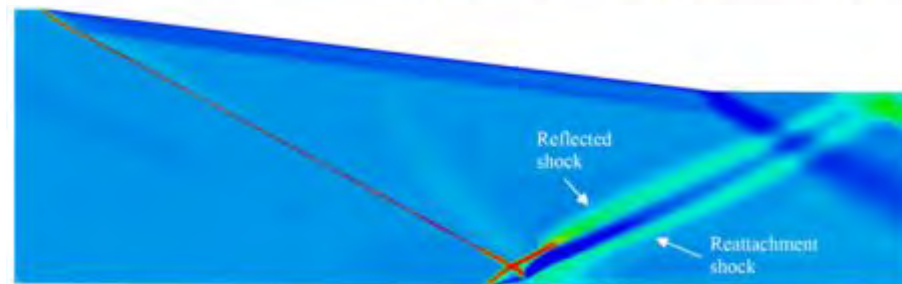
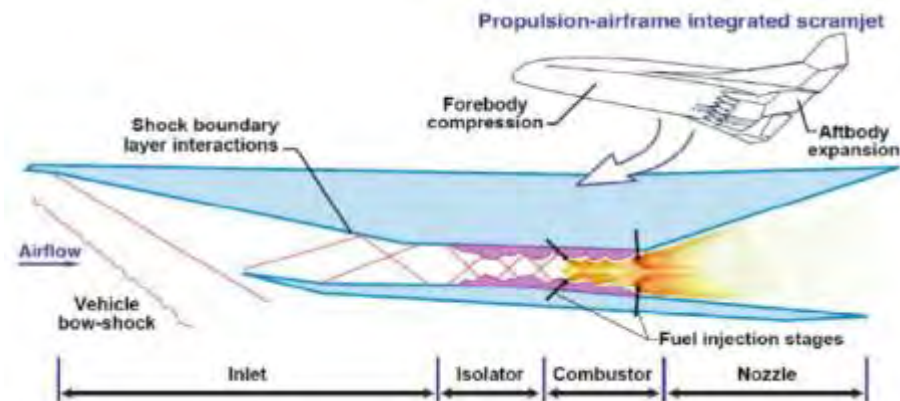
Airbreathing two-stage-to-orbit (TSTO) systems are based on a rocket-based combined-cycle upper stage in which scramjet propulsion eliminates the need to carry a large oxidizer mass, enabling a substantial reduction in the cost per unit mass brought to low Earth orbit.



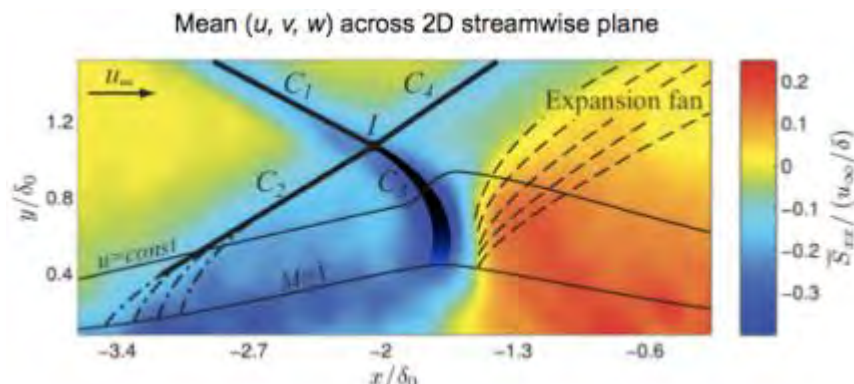
Supersonic Inlets: Shock-Boundary Layer Interaction (SBLI) Control



- ❑ Bleedless mixed-compression inlets need methods to avoid BL separation
- ❑ Maximize inlet pressure recovery
- ❑ Shock-boundary layer interaction (SBLI) can trigger separation at or after shocks
- ❑ AFRL using experiments and numerical simulations to develop suitable control
- ❑ Passive sub-boundary layer vortex generator micro-ramps
- ❑ Alternative passive control elements



Simulations of passive control of shock-boundary layer interaction control using micro-ramps (Galbraith et al. 2009)



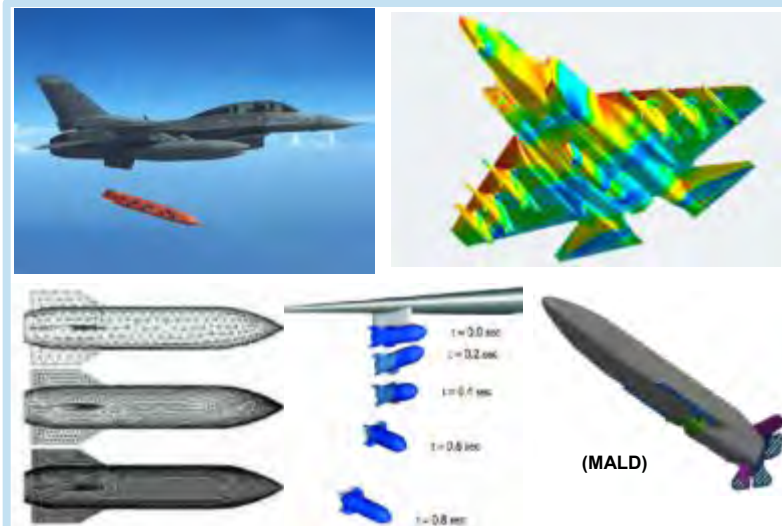


Computational Modeling & Simulation (M&S) to Support Air Force Needs



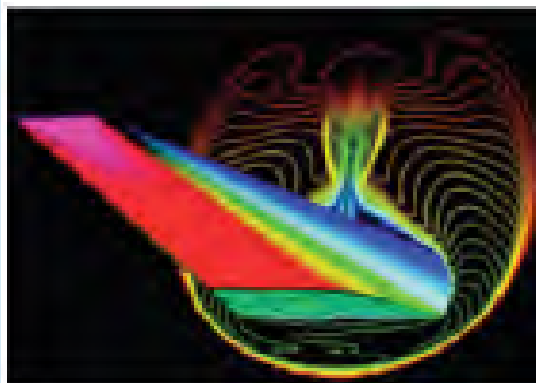
- ❑ Properly integrated M&S can give large reductions in cost of physical testing
- ❑ Continued improvements needed in CFD methods (incl. numerics and physics)
- ❑ E.g., USAF RBS use of CFD to assess payload separation
- ❑ 6-DOF time-accurate trajectory codes using dynamic offset grids
- ❑ Platform/staging configurations exceed what can be tested directly

Computational aeromechanics support to Air Force aircraft/stores compatibility and weapons integration



Responsive and Reusable Booster Stage & Two-Stage-to-Orbit Payload Separation

Hypersonic Aerothermal Laminar and Turbulent Flow



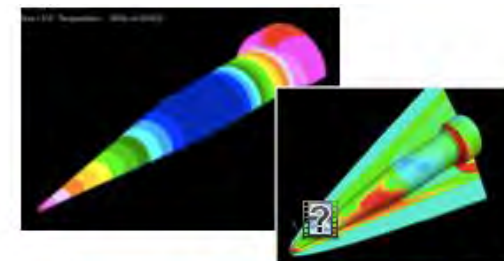
Supersonic & Hypersonic Flowpaths



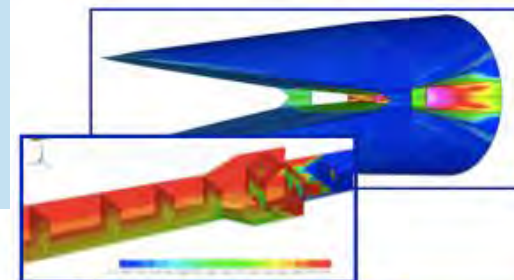
Hypersonic International Flight Research and Experimentation (HIFiRE) Program



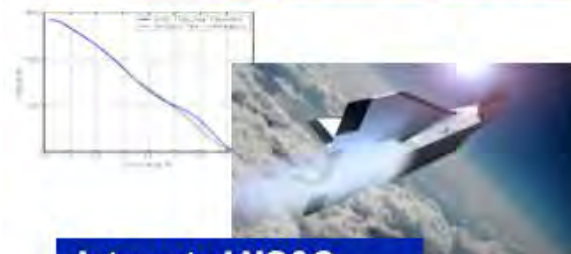
- ☐ HIFiRE flights use sounding rocket descent trajectories to explore fundamental hypersonics technologies
- ☐ AFRL and Australian DSTO with NASA; rocket flights at Woomera, White Sands, and Pacific Missile Range
- ☐ Primary focus on aerosciences and propulsion areas; also stability & control and sensors & instrumentation
- ☐ Propulsion experiments on Flights 2 (US), 3 (AUS), and 6-9 (US/AUS)
- ☐ Scramjet fueling/combustion, integration, performance



Aerodynamics & Aerothermodynamics



Propulsion, Power & Aero-propulsion Integration



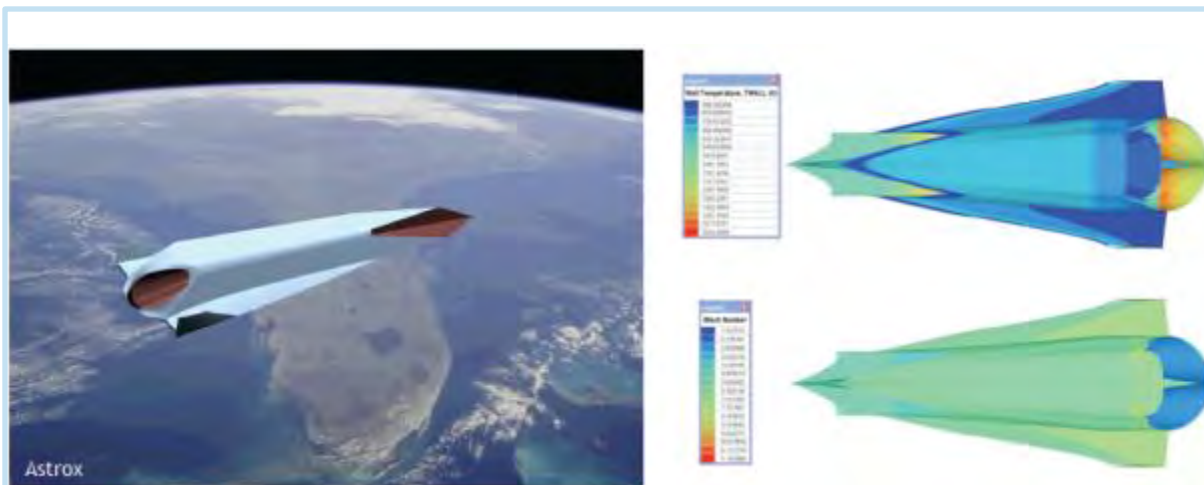
Integrated NG&C



Hypersonic Global ISR Vehicles



- ❑ JP-fueled scramjet propulsion system could potentially enable a medium-size rapid-response ISR vehicle having operationally relevant range capability
- ❑ Mach 6 limit avoids complex thermal management penalties at higher Mach
- ❑ Vertical takeoff / horizontal landing (VTHL) enables single-stage rocket-based combined-cycle (RBCC) system having 5000 nmi range with 2000 lbs payload
- ❑ Integral rocket boost to Mach 3.5 with ram-scram acceleration to Mach 6
- ❑ Resulting notional vehicle is 80 ft long with 42,000 lbs empty weight



Notional Mach 6 single-stage reusable VTHL ISR vehicle with 5000 nmi range (Astrox)

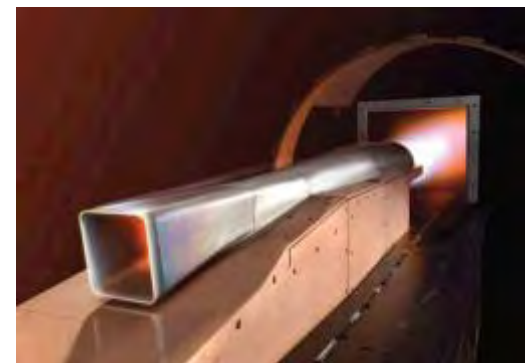
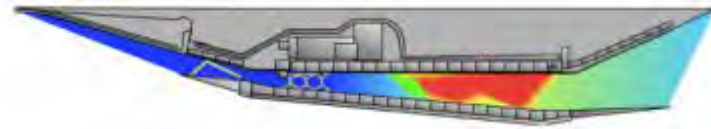




Scramjet Engine Development



- ❑ Hydrocarbon-fueled dual-mode ram/scramjet combustor allows operation over Mach range
- ❑ Thermal management, ignition, flameholding
- ❑ GDE-1 was flight weight hydrocarbon fuelcooled but with open-loop fuel system
- ❑ GDE-2 was closed-loop hydrocarbon fuelcooled system intended for NASA X-43C
- ❑ SJX61-1,2 were closed-loop HC fuel-cooled development/clearance engines for X-51A



Ground Demo Engine (GDE-2)

SJX61-1 Development Engine

SJX61-2 Flight Clearance Engine





Supersonic Propulsion Integration: Combined-Cycle Scramjet Systems



AEDC APTU tests under FaCET of common turbo-ramjet/scramjet flowpath

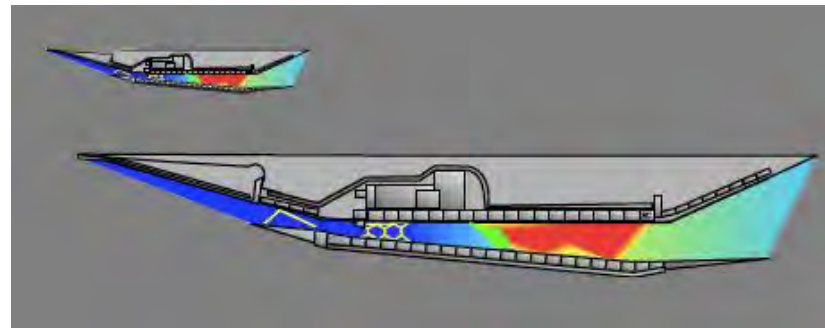


Robust Scramjet Scale-Up Program



X-51A uses small-scale combustor

**Possible follow-on flights
to test navigation and
inert strike on
target**



AFRL Robust Scramjet program

**Scale-up and combustor
reconfiguration for
3X, 10X, 100X
scales?**

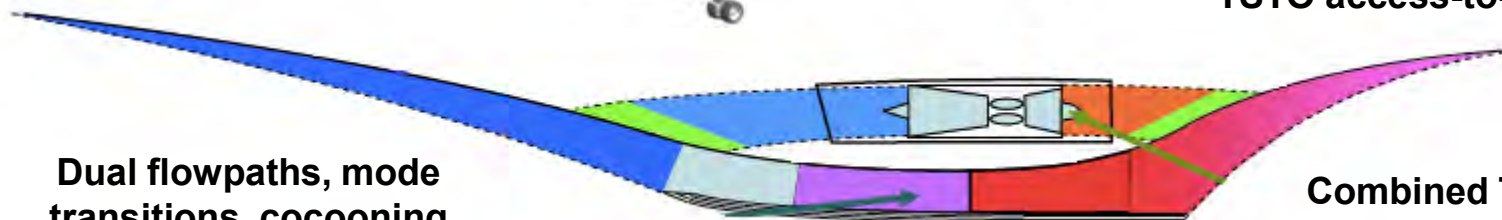
**Large-
scale
vehicle**



**Possible ISR
or global strike vehicle**

**Potential step to
a future airbreathing
TSTO access-to-space system**

**Dual flowpaths, mode
transitions, cocooning**



Combined TBCC nozzle



Vision...



**A 21st Century of
Diverse, Routine, Reliable & Affordable Space Access!**



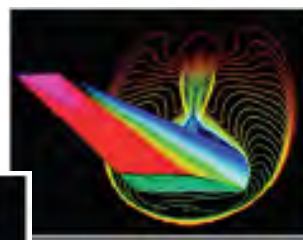
BACKUPS



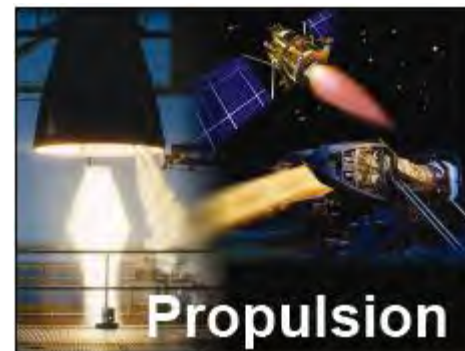
Supporting Technology Directorates for Responsive Space Access



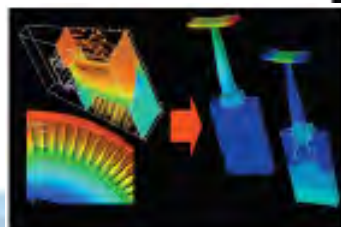
**Aerothermal
Dynamics**



**Advanced
Hypersonics**



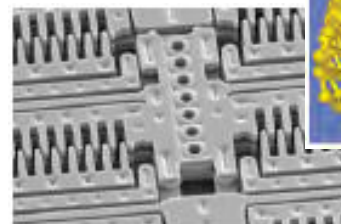
Propulsion



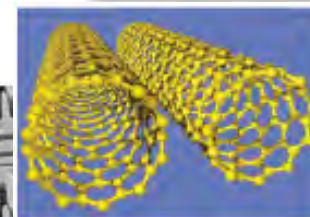
**Perpetual
Simulation**



**Unmanned
Systems**



**Micro-
Mechatronics**



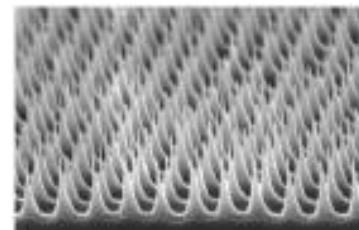
**Nano-tailored
Materials**



**Computational
Simulation**



**Man-as-
machine
systems**



**Nanostructured
Surfaces**



**Materials &
Manufacturing**



United States Strategic Command



Mr. David W. Tyner
Capability and Resource
Integration Directorate – J8
23 June 2011

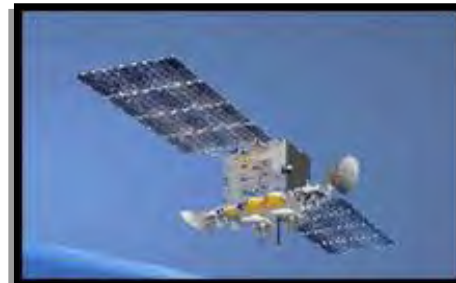
UNCLASSIFIED



USSTRATCOM Responsibilities

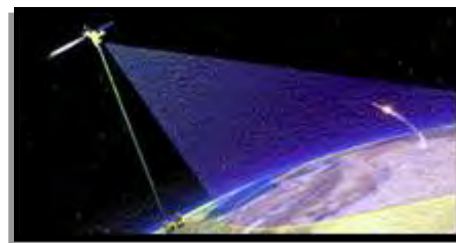
Plan and Execute

- Strategic Deterrence & Nuclear Operations
- Space
- Cyberspace
- Global Strike
- Combating WMD



Plan, Integrate & Synchronize

- Missile Defense
- Intelligence, Surveillance, & Reconnaissance
- Information Operations





Geographically Distributed Component Commanders



JFCC IMD
LTG Formica
Army SMDC



JFCC GS
Brig Gen Wilson
8th Air Force



USSTRATCOM
Gen Kehler



JFCC ISR
LTG Burgess
DIA



USCYBERCOM
GEN Alexander
NSA

JFCC SPACE
Lt Gen Helms
14th Air Force



JIOWC
Mr. Johnson

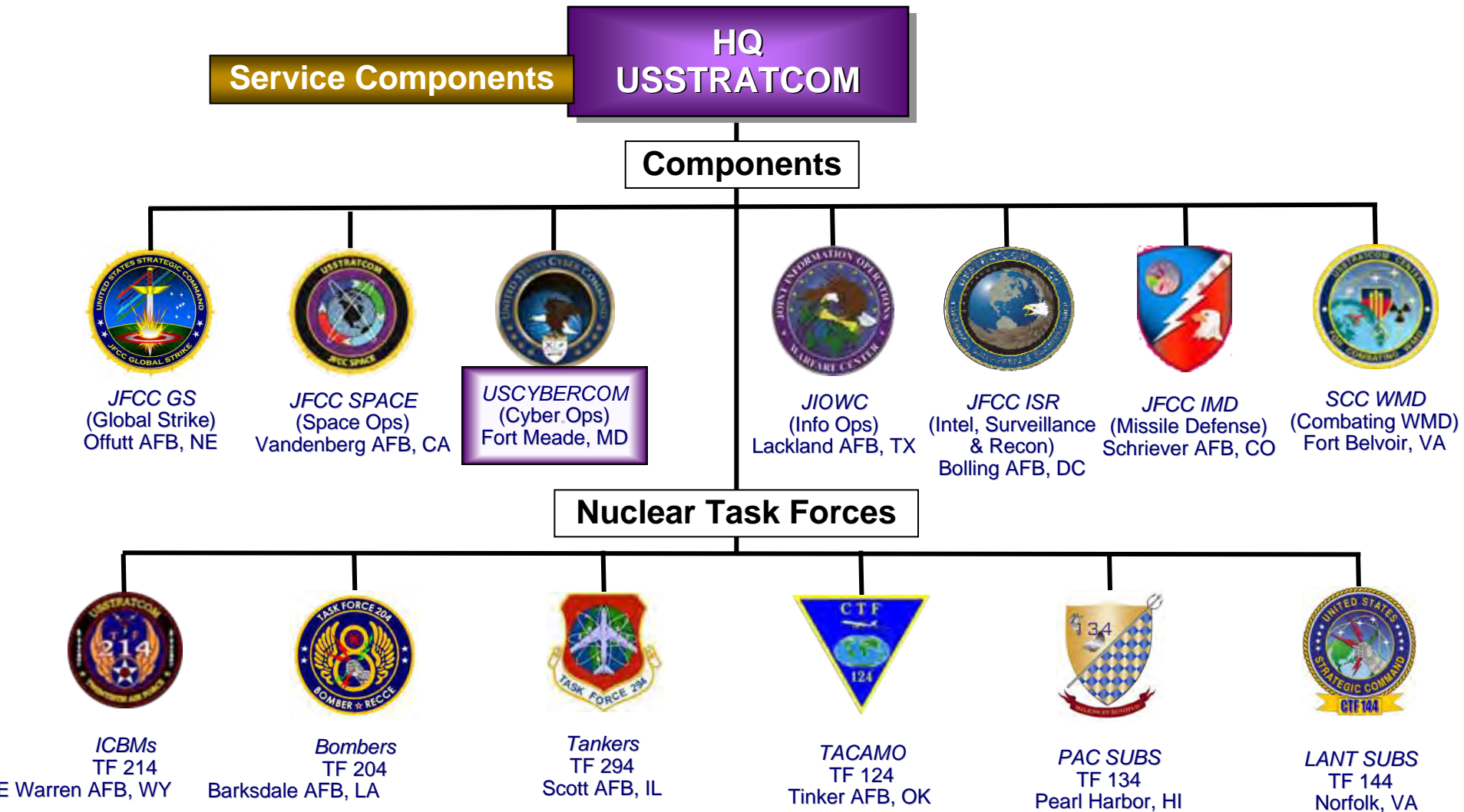


SCC WMD
Mr. Myers
DTRA





Component and Task Force Structure



How We Are Organized



USSTRATCOM Task Forces

- **Aerial Refueling/Tankers (TF 294)**
 - USAF refueling aircraft enhance Command's capability to conduct global combat and reconnaissance operations
- **Airborne Communications (TF 124)**
 - Navy E-6B aircraft provide a survivable communications link between national decision makers and the nation's strategic forces
- **Ballistic Missile Submarines (TFs 134/144)**
 - Navy ballistic missile submarines provide launch capability from around the globe--most survivable leg of US strategic forces
- **Strategic Bomber & Reconnaissance Aircraft (TF 204)**
 - USAF aircraft deploy globally to project air power and support Command's reconnaissance mission
- **Land-Based ICBMs (TF 214)**
 - USAF ICBMs, dispersed in hardened silos, provide a quick-reacting and highly reliable component of US strategic forces

Task Forces Enable Command Mission Execution



Headquarters Organization



CCC
CMSgt Narofsky



CD
VADM Haney



CC
Gen Kehler



CS
MG Grimsley



J1
Col LoCastro



J3
Maj Gen Biscone



J5
Maj Gen Desjardins



J8
Mr. Callicutt



J9
Mr. Gandy



J2
Brig Gen George



J4
CAPT Power



J6
Ms Kelley



J7
Mr. McVay



USSTRATCOM Operations/Activities Snapshot

Strategic Deterrence/Nuclear Ops

24x7 Deterrence Operations
Nuclear Enterprise Leadership
Nuclear Command & Control

Space Operations

SSA Ops: Tracking 22,000+ Objects
Conjunction Analysis: 1,100 Satellites
20+ SSA Sharing Agreements
Monitoring Space Weather

Cyberspace Operations

Operation BUCKSHOT YANKEE
Defense of the GIG
Cyber Ops As Directed

Missile Defense

Synchronize Global MD Planning
Coordinate Global MD Asset Management
TD-2 Launches: Support GCCs

Surveillance & Reconnaissance

Global Force Management of ISR Assets
Support to GCCs

Information Operations

Training Support to GCCs
Support to Other COCOM Ops

Combating WMD

Synchronize Global CWMD Planning (Global Sync Conf)
Establishing SJFHQ-E of WMD

Cross Mission Area

Support to PACOM: Operation TOMODACHI
Support to AFRICOM: Operation ODYSSEY DAWN
Support to CENTCOM: STRATCOM Forward Integration Teams (SFIT)
Operation BURNT FROST

Exercises & Training

GLOBAL THUNDER
AUSTERE CHALLENGE (EUCOM)
GLOBAL LIGHTNING
BULWARK DEFENDER

Integrated Trans-Regional Operations: Supporting & Supported



Science & Technology Outreach

A world map is displayed in the background, color-coded by US military command regions. The regions include: USNORTHCOM (North America, green), USSOUTHCOM (South America, teal), USAFRICOM (Africa, yellow), USEUCOM (Europe, pink), and USPACOM (Pacific, light blue). The map also shows major oceans and continents.

Process to Monitor New & Emerging Technologies

S&T Enterprise Management Board



S&T Outreach Process Goals

- **Identify relevant new technologies earlier**
 - Keep abreast of emerging Blue/Red Team technologies
 - Socialize new technologies throughout Command
- **Inform Labs of USSTRATCOM mission needs**
 - Current Operations & Projected Capability Gaps
 - “National Labs” → DoD Labs, FFRDCs/DOE Labs, UARCs, Defense Research Agencies (e.g., DARPA)
- **Leverage existing Command-Lab relationships; forge new ones**
- **Implement S&T Battle Rhythm around S&T IPL Process**

Become USSTRATCOM's "One-Stop" S&T Venue



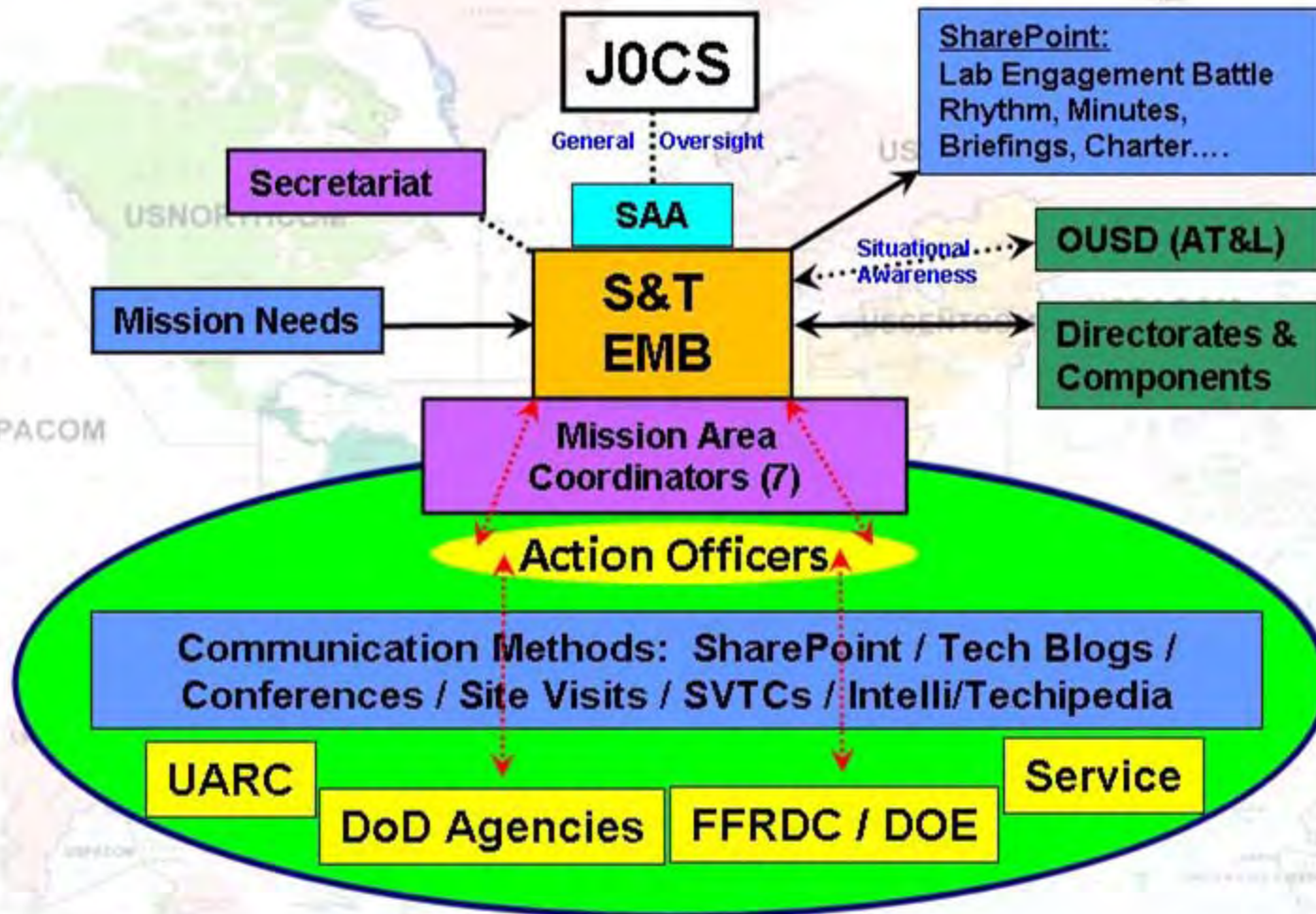
S&T Outreach Process Overview

- **S&T Enterprise Management Board (EMB)**
 - Chaired by Senior Analytic Advisor, assisted by Secretariat
 - Formalized with a Charter
 - Comprised of Coordinators Aligned With 7 Mission Areas
 - Nuclear, Space, Cyber, CWMD, IMD, IO, ISR
 - Other Members: SAG/Lab LNOs, S&T Reps, Special Advisors
- **Coordinators / AOs / LNOs**
 - Coordinators act as information brokers between AOs/EMB
 - AOs interface with Labs as requested by EMB or directed by J-Directorates/Components
 - Lab LNOs/Advisors facilitate communication and support EMB

Command-Wide Participation in S&T Process

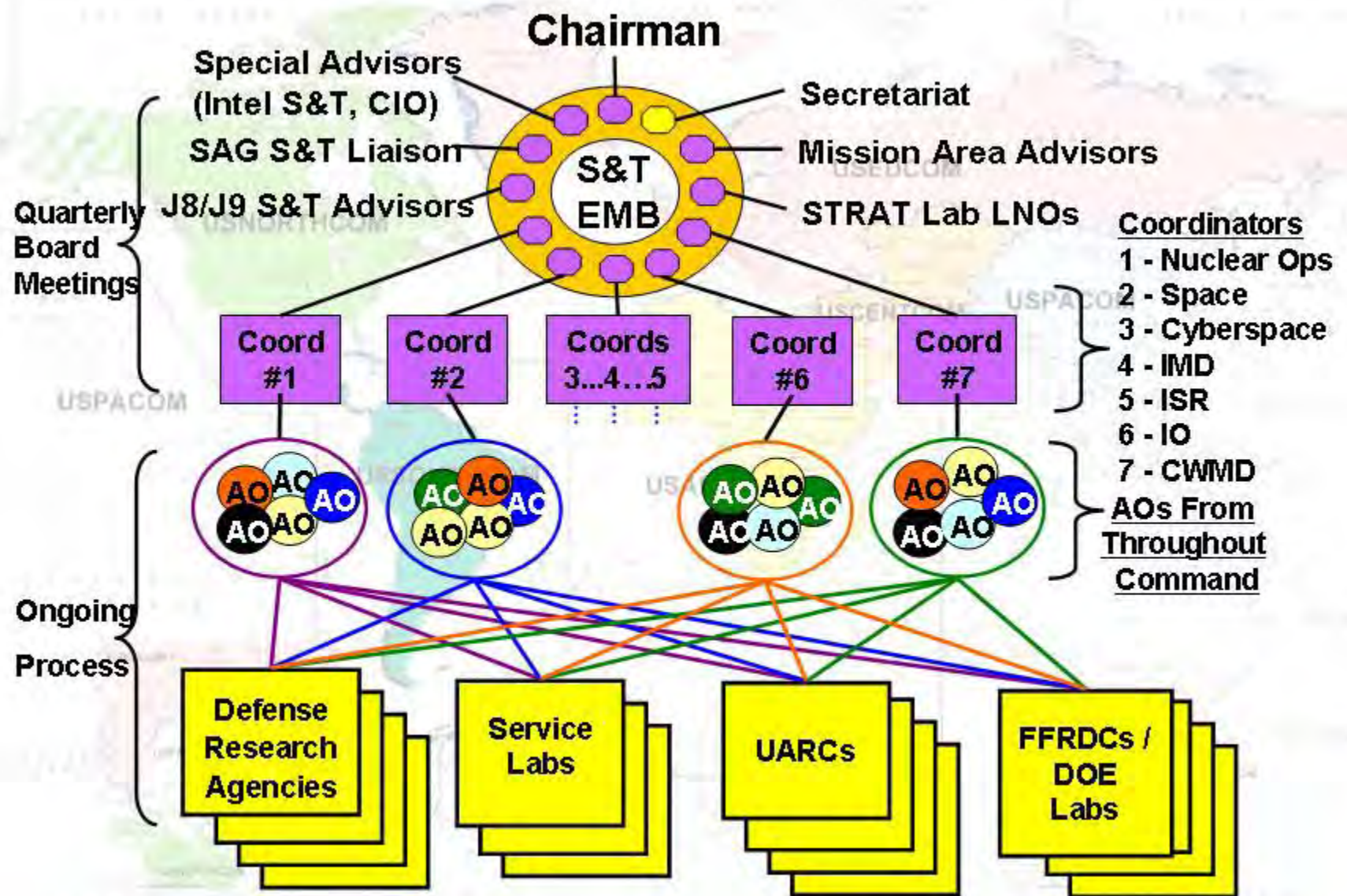


S&T Outreach Process Scope





S&T Outreach Process Coordination





S&T Outreach Process Deliverables

Gap: No formal Command process to monitor relevant new technologies at the Labs

- **Through a Lab Engagement Strategy, the S&T EMB will:**
 - Regularly collect new technology developments from the Labs
 - Forge new opportunities to convey mission needs to the Labs
- **S&T EMB Deliverables**
 - **Technology Updates** – Disseminated throughout Command
 - **S&T IPL Recommendations** – Input to OSD/AT&L
 - **Annotated Mission Area Interest List (MAIL)** – Feedback to S&T Community

Link new technologies with Command Mission Needs



S&T / Experimentation Branch

Branch Chief: Mr. Chuck Hutchison (402) 232-5347

- **S&T Team**

- Dr. Mark Brown (402) 232-4114
- Mr. Eric Dernovish 294-0447
- Mr. David Beberwyk 294-5472
- Mr. Brian Liesveld 232-1422
- Mr. Tim Fowler 232-1421

- **Experimentation Team**

- Mr. Bill Delaney (402) 294-7650
- Mr. Monty Hoskinson 232-9872
- Mr. Ray Varney 294-7523
- Mr. Brian Shook 232-8617

Command-Wide Participation in S&T Process

United States Strategic Command



Questions?



USSTRATCOM Operations/Activities 2008-2011

Operation BURNT FROST: Intercepted inop NRO satellite

Operation BUCKSHOT YANKEE: Response to 2008 cyber attack

Taepo-Dong 2 Launch: Response to N. Korea missile tests

Recurring Events:

GLOBAL THUNDER: Exercise focused on nuclear command and control, mission execution

AUSTERE CHALLENGE: USEUCOM full-spectrum operations exercise, USSTRATCOM supported

BULWARK DEFENDER: Joint cyber defense exercise

Ongoing Support to Overseas Contingency Operations....

Global Integrated Operations

**The Classification of this Brief is:
UNCLASSIFIED**



NORAD and USNORTHCOM Science and Technology

**Dr. Susanne T. Wirwille
Director, Science and Technology**



NORAD & USNORTHCOM Missions

- **North American Aerospace Defense Command (NORAD)**
 - **Bi-national Command established between the Governments of the U.S. and Canada in 1958**
 - **Three Regions: Alaskan NORAD Region (ANR), Canadian NORAD Region (CANR), and Continental NORAD Region (CONR)**
 - **Conducts aerospace warning, aerospace control, and maritime warning in the defense of North America**
- **United States Northern Command (USNORTHCOM)**
 - **Unified Command established in 2002**
 - **Subordinate Commands: Joint Force HQ National Capital Region, Joint Task Force (JTF) Alaska, JTF Civil Support, JTF North, Army North, Air Force North**
 - **Conducts homeland defense, civil support, and security cooperation to defend and secure the United States and its interests**

Two Commands ... Working Together



...Across a Range of Operations...

Homelands Defense



- Aerospace Warning
- Aerospace Control
- Maritime Warning

Security Cooperation



Civil Support



- Air
- Missile Defense
- Maritime
- Land

- Canada
- Mexico
- The Bahamas



- Disaster Relief
- CBRN Incident
- Civil Disturbance
- Special Events

...With a Host of Partners...

International



Department of Defense



Interagency



Approximately 60 People Representing More Than 50 Agencies



NORAD and USNORTHCOM Focus Areas

- **Counter-Terrorism and Force Protection**
- **Transnational Criminal Organizations**
- **Defense Support of Civil Authorities**
- **Chemical, Biological, Radiological, Nuclear Consequence Management**
- **Maritime Warning and Control**
- **Aerospace Warning and Control**
- **Missile Defense**
- **The Arctic**

Cross-cutting Focus Area: Technical Opportunities



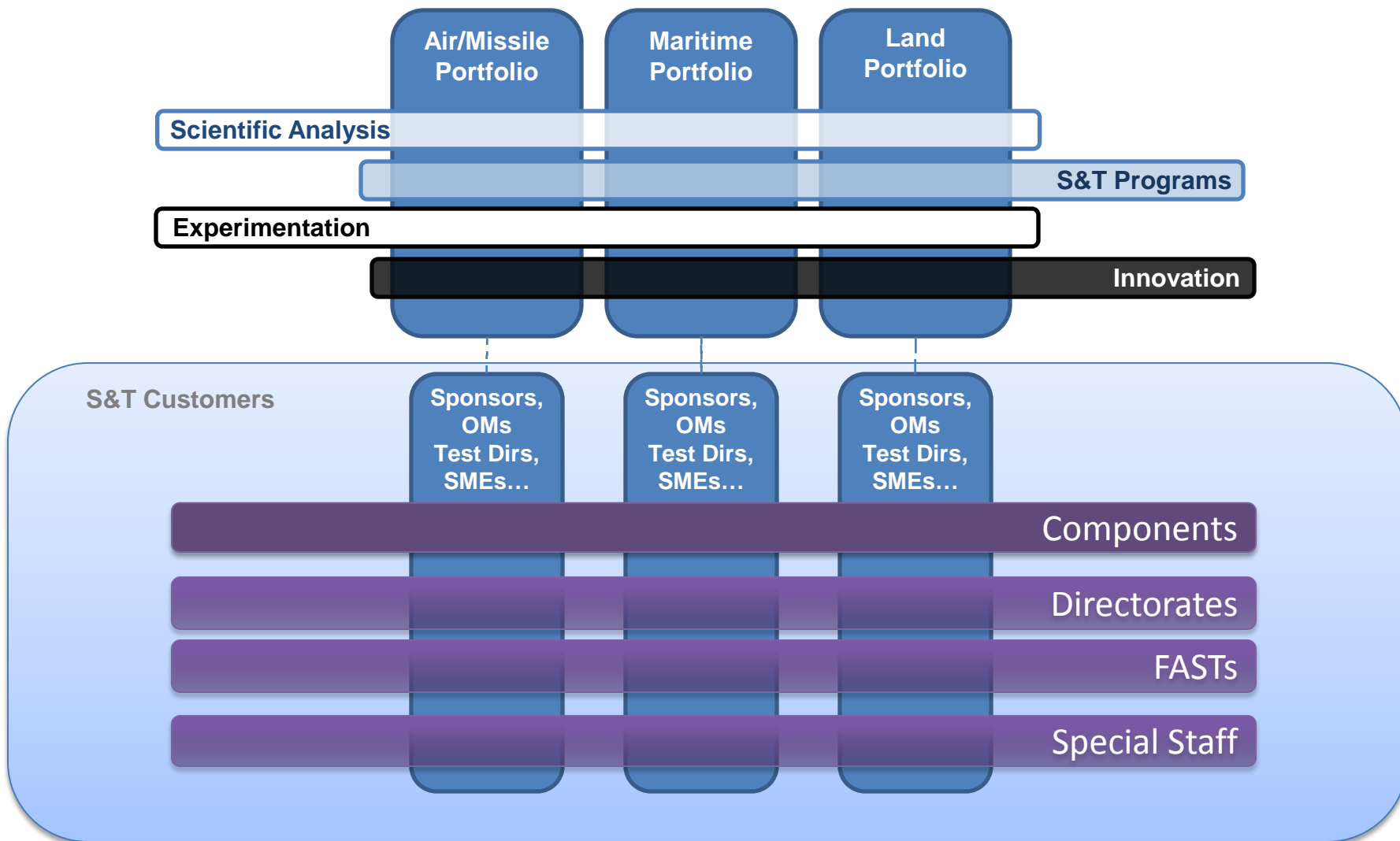
N-NC/S&T Mission and Functions

- **Advises CDR, NORAD and USNORTHCOM and Deputy Commanders on all S&T matters**
- **Creates and executes strategies and supporting plans to exploit and develop innovative processes, technology and prototypes to respond to the needs of NORAD and USNORTHCOM**
 - **Leads studies, innovation, experimentation, enabling technologies, technology demonstrations, military utility assessments, and Joint Tests**
 - **Performs US and Canadian outreach efforts to identify, assess and integrate potential solutions for identified capabilities and requirements**
 - **Articulates needed capabilities with R&D organizations**
- **Critically reviews and eliminates unpromising programs and projects**
- **Synchronizes S&T activities across NORAD and USNORTHCOM staffs**
- **Focus is 6 months out to 15 years with innovation cycles of 6 - 36 months**

S&T provides leadership and oversight of science, innovation and future capability initiatives in order to improve homeland defense, defense support of civil authorities, theater security cooperation, and other NORAD and USNORTHCOM mission capabilities

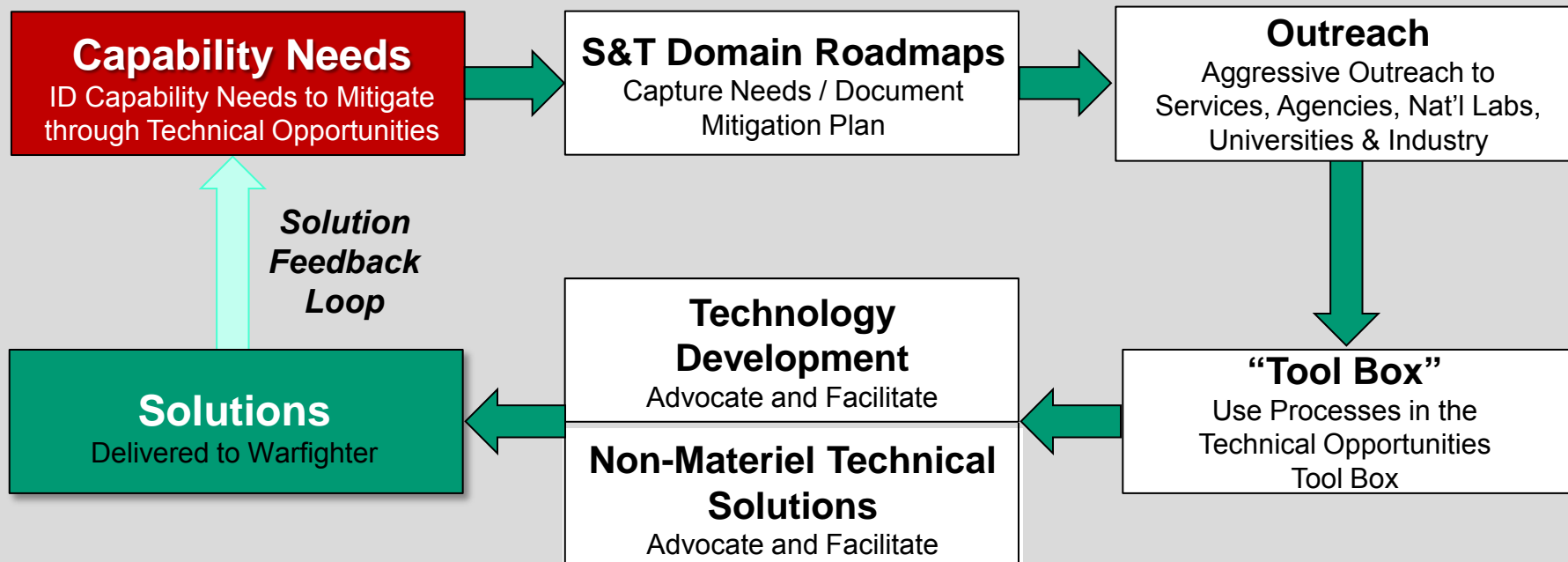


S&T Functional Organization





Technical Opportunities





NORAD and USNORTHCOM

***Defending our
Homelands***





Welcome to NORAD Tracks Santa

Santa has completed his flight this year.
Come back next December to see him fly
again!



Rapid Fielding Portfolio, Strategies & Opportunities

Earl Wyatt

**Deputy Asst Sec of Defense, Rapid Fielding
OASD(R&E)**



Topics

- The Need
- An Enduring Response
- A Strategy for Implementation
- Innovation Delivered
- Looking Ahead

Japan's Fukushima Nuclear Power Plant
imaged 16 March 2011 by Cosmo SkyMed satellite,
enabled by Rapid Fielding's Foreign Comparative Testing



The Need



“....the Department needs a means to quickly prioritize and quantify requirements and to insure that the resources are available to enable rapid fielding of capabilities inside of the Department’s Planning, Programming, Budgeting and Execution System (PPBES) cycle” Quadrennial Defense Review 2010



**“We must rapidly react to warfighting needs with new technology from commercial sources, prototyping or accelerated maturation of technology from the Science and Technology base.”
Sec. Gates, Jan 09**

“Rapid fielding requires rapid performance from the entire AQ team, including the test and evaluation community ... without delaying our response to these urgent requirements ...”

Dr. Carter, Mar 09





An Enduring Response

- ***USD AT&L – Established a senior integration team to prioritize, resource and provide senior-level oversight of urgent operational needs***
- ***ASD(R&E) – Established the ODASD(Rapid Fielding)***
 - ***Accelerate technical capability to win the current fight***
 - ***Support and engage in JUONs resolution***
- ***Build an enduring rapid demonstration, assessment and fielding model for DoD that invests in near horizon concepts and rapidly transitions them for time sensitive operational needs***
 - ***Shape Quick Reaction Special Projects, Joint Capability Technology Demonstration, Foreign Comparative Testing, Biometrics S&T and Emerging Capabilities program elements to achieve the rapid fielding objective***



A Strategy for Implementation

● **Identify, Develop and Demonstrate Concepts and Capabilities Providing a Competitive Advantage**

- Identify existing solutions capable of satisfying new JUONs within 12 months, or
- Work with the R&E Enterprise (e.g., Services, Labs, etc.) to develop solutions for JUONs that can be resolved within 24 months

● **Ensure Responsive Processes**

- Resource efforts that support continuous COCOM engagement
- Conduct continuous review of acquisition related processes (needs validation, acquisition priorities, resourcing, utility assessments)

● **Conduct Anticipatory Efforts to Positively Impact Operational Readiness**

- Engage stakeholders to help identify technology trends, potential vulnerabilities and disruptive threats
- Expand problem/solution space to include interagency, non-kinetic, human social culture, and dual use technologies

● **Make Efficient Use of the Instruments at our Disposal**

- Employing the use of fieldable prototypes (organically / industrially);
- Providing operationally representative integration venues (JERC, Stiletto, Thunderstorm, etc.); and,
- Expanding supplier base to include to non-traditional performers



Implementation Partners

● Identify, Develop and Demonstrate Concepts and Capabilities Providing a Competitive Advantage

- Combatant Commands, Services, Defense Agencies (e.g., NSA, DTRA, DISA, DARPA)
- Other Federal Agencies (e.g., DHS, DoS, NASA)
- Industry, with particular emphasis on small business, and the OSBP

● Ensure Responsive Processes

- Congressional Defense Committees
- OSD Policy and OSD OSBP
- OSD General Counsel
- OUSD(AT&L)
 - OASD(R&E)
 - Joint Rapid Acquisition Cell (JRAC)
 - Defense Procurement and Acquisition Policy (DPAP)

● Conduct Anticipatory Efforts to Positively Impact Operational Readiness

- Combatant Commands
- Services
- Defense Agencies (e.g., NSA, DTRA, DISA, DARPA)
- Other Federal Agencies (e.g., DHS, DoS, NASA)
- Industry, with particular emphasis on small and non-traditional businesses, and the OSBP

● Make Efficient Use of the Instruments at our Disposal

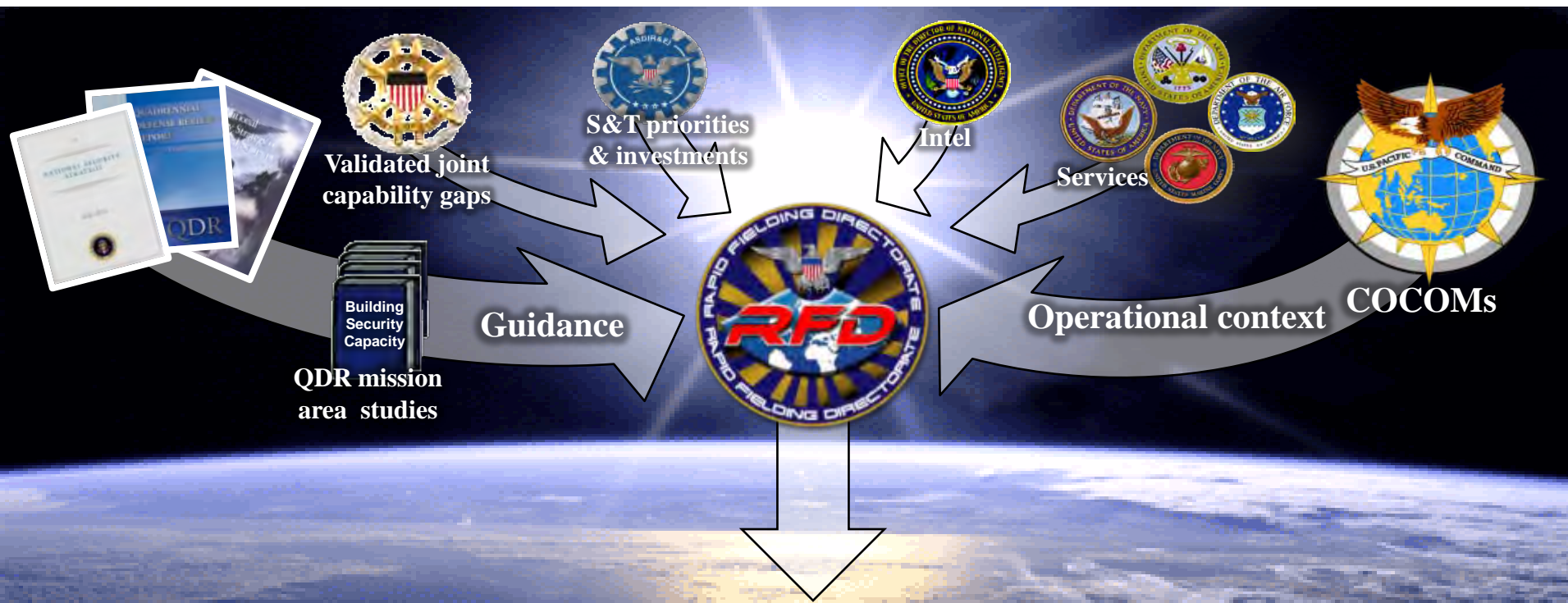
- R&E Enterprise (Labs, FFRDCs, Coalition Partners, GIFs, Non-Traditional Suppliers)



Heavy equipment recovery with the Joint Recovery and Distribution System JCTD in Afghanistan. Conducted in partnership with US Transportation Command, US Army and industry



Innovation Delivered



Identify, Develop, and Demonstrate Innovative Solution Options for Joint Capability Areas

Force Protection

- Airborne Tac Extraction (FCT)
- Enhanced Mortar Tgt Sys (ECTD)
- Nat'l Technical Nuclear Forensics (JCTD)
- Hostile Fire Detection Sys (QRSP)
- Persistent Grnd Surveillance System (JCTD)

Battlespace Awareness

- Rapid Reaction Tunnel Detection (JCTD)
- XFC Submerged launch UAV (QRSP)
- Eagle Vision (FCT)
- Project SHIVA (QRSP)
- Thunderstorm Test Venue (ECTD)
- Stiletto Maritime Test Platform (ECTD)

Command & Control

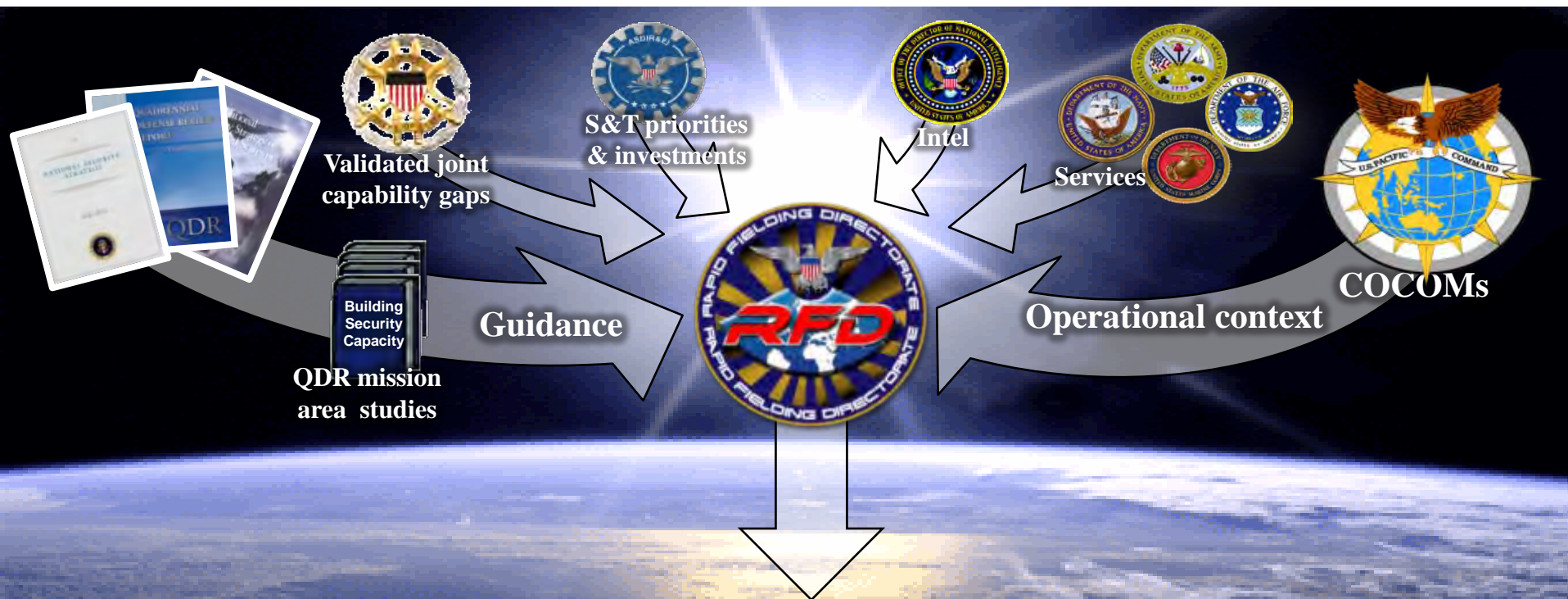
- Mobile Modular C2 (QRSP)
- Nat'l Senior Leadership Decision Support Services (JCTD)
- Theater Information Sharing Sharing (JCTD)
- Tactical Edge Data Solution (JCTD)

Logistics

- PEAK (JCTD)
- Critical Runway Assessment & Repair (JCTD)
- Submersible Multi-Fuel Outboard Engines (FCT)
- Deployable Rigid Wall Shelters (FCT)
- Project Pelican (ECTD)



Looking Ahead



Identify, Develop, and Demonstrate Innovative Solution Options for ASD R&E Focus Areas

Human Systems

EW & Protection

Autonomy

Resilient Systems

Counter WMD

Cyber



Rapid Fielding Points of Contact

● Efficiently Develop/Demonstrate Concepts & Capabilities that Provide Competitive Advantage

- Shape JCTD, QRSP, FCT, Biometric/Forensics/ECD PEs
 - Points of Contact: Wyatt/Riley (via CAPT Wright – lewin.wright@osd.mil)

● Ensure Responsive Processes

- Resource efforts that support continuous COCOM engagement
 - Points of Contact: Vogt (chris.vogt@osd.mil)/ Fogg (glenn.fogg@osd.mil)
- Conduct continuous review of acquisition related processes (needs validation, acquisition priorities, resourcing, utility assessments)
 - Points of Contact: Cundiff (dan.cundiff@osd.mil)/ Purdy (ellen.purdy@osd.mil)

● Conduct Anticipatory Efforts to Positively Impact Operational Readiness

- Engage stakeholders to help identify technology trends, potential vulnerabilities and disruptive threats
 - Points of Contact: Fogg (glenn.fogg@osd.mil) / Vogt (chris.vogt@osd.mil)
- Expand problem/solution space to include interagency, non-kinetic, human social culture, and dual use technologies
 - Points of Contact: Riley/Fogg (glenn.fogg@osd.mil)

● Make Efficient Use of the Instruments at our Disposal

- Employing the use of fieldable prototypes (organically / industrially)
 - Point of Contact: Purdy (ellen.purdy@osd.mil)
- Providing operationally representative integration venues (JERC, Stiletto, Thunderstorm, etc.);
 - Point of Contact: COL Kelleher (pat.kelleher@osd.mil)
- Expanding supplier base to include to non-traditional performers
 - Point of Contact: Cundiff (dan.cundiff@osd.mil)



Questions ?

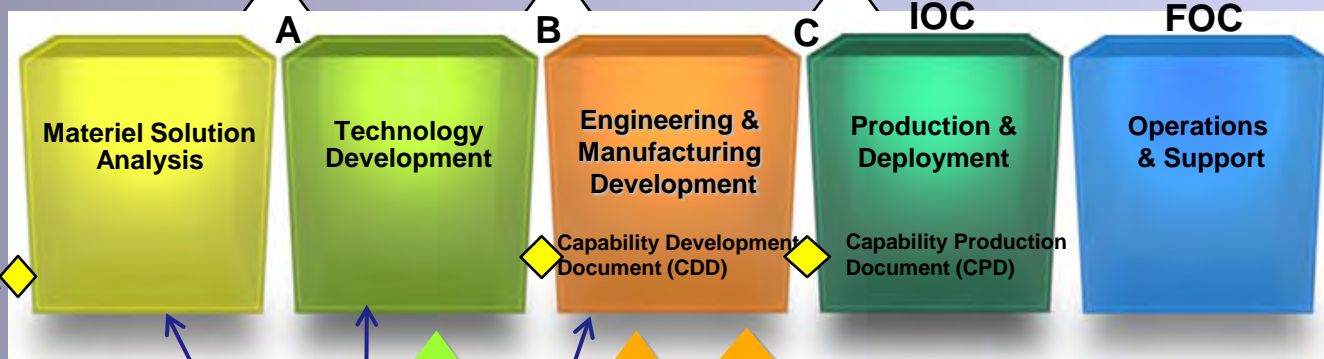


**US Marines demonstrate water purification system in Honduras
in the Pre-positioned Expeditionary Assistance Kits JCTD**



Technology Transition Paths

Deliberative Path



Accelerated Path

